PC MAGAZINE

FIRST LOOKS

IBM's Audio Visual Connection Brings Multimedia To the PC

ENDURANCE TESTS

386s and Portables Revisited: How They Hold Up Over the Long Haul

CONNECTIVITY

DEC's PC LAN: How It Stacks Up Against Novell And 3Com

FREE UTILITY

Use PCREMOTE For Easy Access to Faraway Machines

VOLUME 9 NUMBER 1 THE INDEPENDENT GUIDE TO IBM-STANDARD PERSONAL COMPUTING JANUARY 16, 1990

The Best of 1989

- **6th Annual Awards for Technical Excellence**
- **The Top Products:** Editors' Personal Picks
- **Scalpel, Please:** Bill Howard Notes The Year's (Less) Memorable Moments

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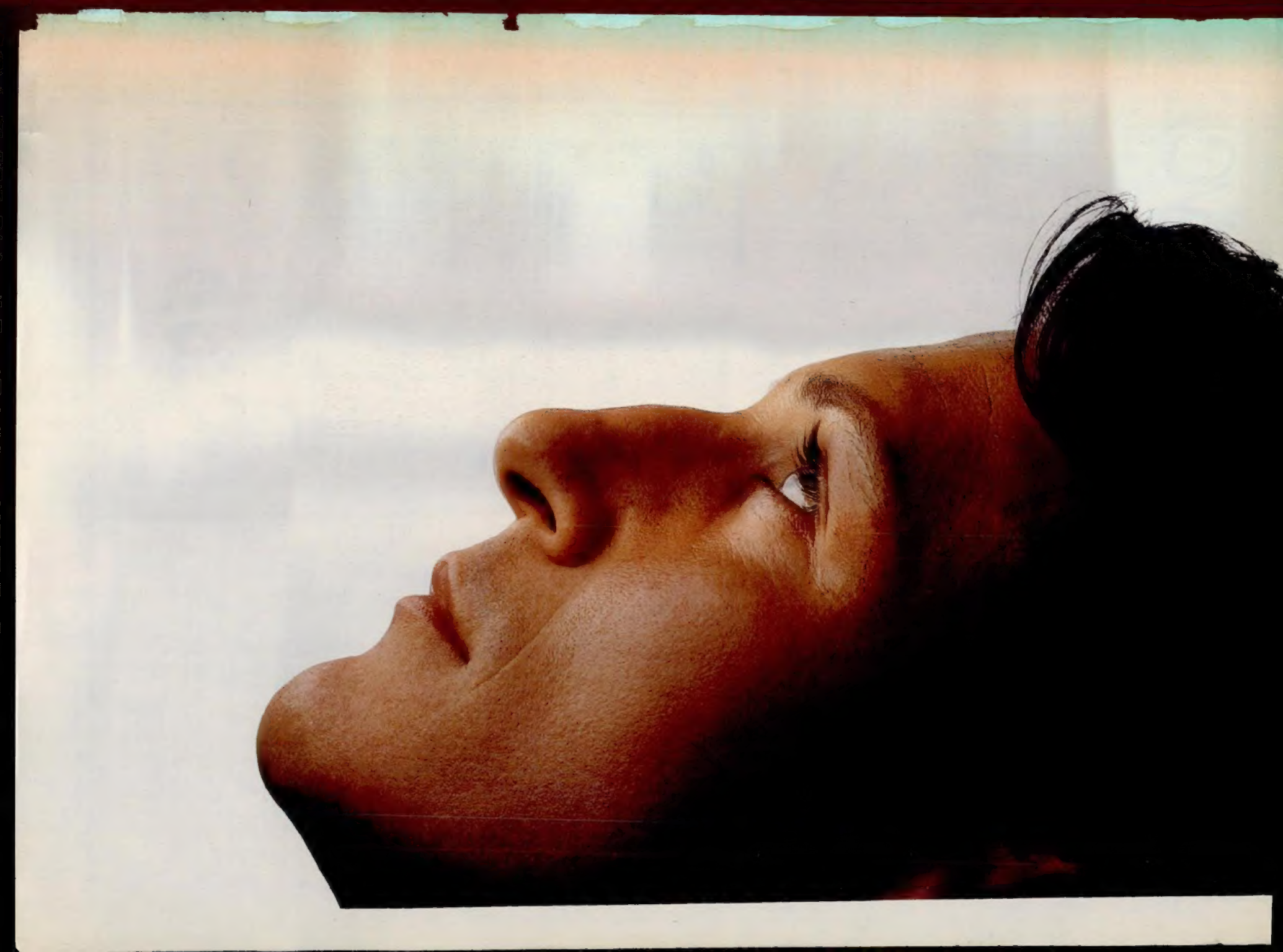

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In the past 5 years we've grown from a local business with only a single office to a well-established operation with 30 offices throughout New England. An investment in Delman can assure a strong return for a wide variety of reasons.

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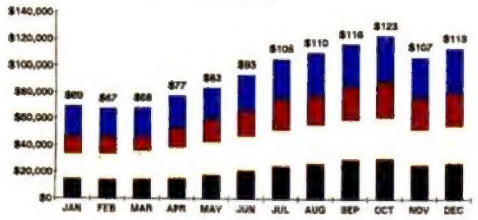
Sales By State



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To: Staff
Re: We've adopted a new standard - *Microsoft Works*

Microsoft Works is the perfect product for our growing business. Here's why:

Online Help & Training Make Works Incredibly Easy to Learn and Use. Only Works provides task-sensitive help and online training from anywhere in the product at the touch of a single key.

Multiple Windows and WYSIWYG Styles On-screen Add Dramatic Visual Quality to Microsoft Works 2.0. With multiple windows, you can work with up to eight different files at once, side-by-side or overlapping - just as if they were on your desk. With WYSIWYG styles, you can see **bold**, *italic*, underline and more on-screen.

Print Preview Lets You View Documents On-screen. Preview footnotes, headers, footers, margins, page breaks, font sizes, graphs, and paragraph borders on-screen *before* you print.

Create the Highest Quality Output. With Works you can easily merge text, tables, and charts into a single document, then print on any one of over 220 printers. Works even supports PostScript printers.

Manage Your Business Day with New Built-in File Management and Alarm Clock Utilities. Without leaving Works, you can perform eight DOS commands. And, with the new alarm clock & appointment manager, you can display a reminder message on-screen at any time.

Here's a Summary of the Features in Microsoft Works 2.0:

- 100,000 word spell-checker and 30,000 keyword thesaurus
- Footnotes and multiple line page headers and footers
- Pop-up calculator and automatic phone dialer
- Includes utilities to manage files and run other programs
- Paragraph borders for emphasis
- Create customized forms with the fast and flexible database
- Runs great with MS Mouse (or compatible) and with Hayes compatible modems
- Built-in macros to automate repetitive tasks
- Convert files to/from MS Word, WordPerfect, DisplayWrite, WordStar and more
- 256x4096 Lotus 1-2-3 and MS Excel compatible spreadsheet (.WKS and .WK1)
- Fast, easy mail merge and mailing label generator
- LIM 3.2 and 4.0 expanded memory support
- Supports any of the popular networks including Novell and 3Com

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DELMAN CONSTRUCTION

DELMAN CONSTRUCTION - Kennebunkport Office
Revenue /Cost Breakout

REVENUES	JAN	FEB	MAR	APR	MAY
Additions	$14,500	$13,800	$18,900	$27,650	$32,370
Items Total	$2,273	$1,959	$2,415	$2,931	$3,785
Roofs	$265	$248	$271	$317	$334
Porches	$361	$260	$285	$304	$353
Driveways	$595	$413	$577	$712	$927
Windows	$94	$105	$201	$153	$339
Gazebos	$737	$681	$808	$1,117	$1,450
Bathrooms	$221	$252	$273	$328	$382
Total Revenues	$16,773	$15,759	$21,315	$30,581	$36,155
EXPENSES	**JAN**	**FEB**	**MAR**	**APR**	**MAY**
Supplies	$3,245	$2,852	$3,220	$5,329	$7,325
Salary	$2,100	$2,100	$2,100	$2,900	$2,900
Benefits	$175	$175	$175	$215	$215
Rent	$1,850	$1,850	$1,850	$1,850	$1,850
Insurance	$590	$673	$802	$960	$1,056
EXPENSES	$8,169	$7,859	$8,381	$11,488	$13,580
NET PROFIT	$8,604	$7,900	$12,934	$19,093	$22,575

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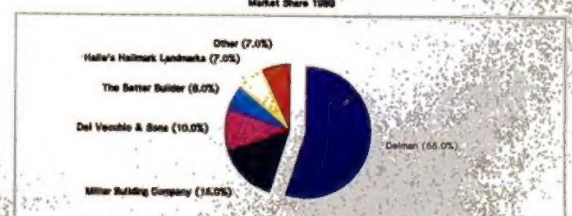
Market Share 1989



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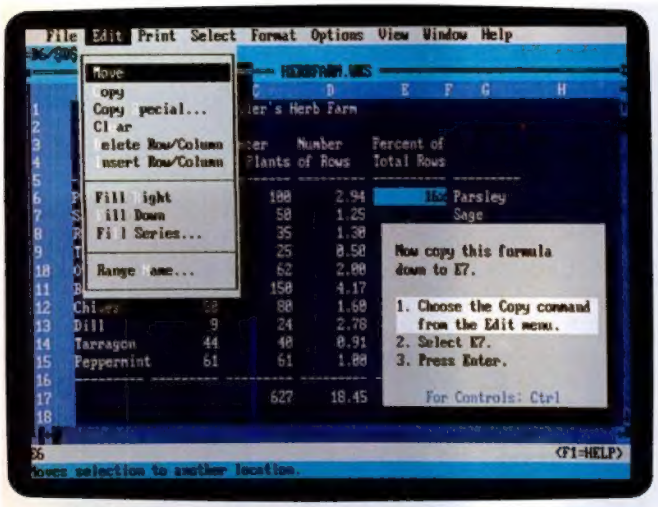
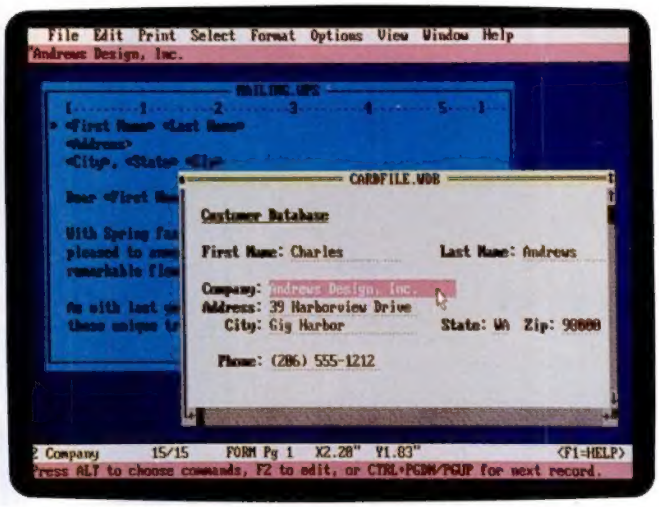
It's almost impossible to show you all the things new Microsoft Works 2.0 can do. So we'll tell you. (Hint: read the memo.)

In all its simplicity.



You can be working before you know it. Microsoft Works provides built-in help and training that takes you through each application, step-by-step.



Everything's easier when you can see what you're doing. With overlapping windows, Works lets you see up to eight different documents at the same time.

There are people who say that powerful software is too complicated to use. And others who say that simple software can never have enough power to meet your needs.

Fortunately, you won't find any of these people working at Microsoft.

Which brings us to new Microsoft® Works 2.0. Software that has all the powerful tools you need in one easy-to-use program.

You get business applications like word processing with a spelling checker and thesaurus, a spreadsheet with business graphics, a database with reporting and a communications module all rolled into one.

All are powerful enough to stand on their own, and handle whatever numbers, words and data you can throw at them.

At the same time, they're a piece of cake to learn and use.

For openers, only Works has built-in training to get you up to speed quickly.

Once you're started, you'll see that each application has the same look on-screen. Which means there's nothing difficult about moving back and forth between, say, your spreadsheet and your word processor. Then into your database. And back out again. You can even move data between all the modules. Easily.

When you do have a question, it's simple to get an answer. Works provides help at the touch of a single key.

The end result is better-looking, more sophisticated output on everything: correspondence, marketing materials, sales information, financial data. Put together in an incredible variety of combinations with much less effort. And much more impact.

If you'd like to know more, call us direct at (800) 541-1261, Dept. K39. We'll answer your questions, in simple terms.

And, if you buy now, we can make your life even easier. By throwing in a free grammar and style checker with your Microsoft Works.*

So when someone tells you that you just can't get power and simplicity in the same software program, tell them there is a solution. Microsoft Works.

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CIRCLE 280 ON READER SERVICE CARD

Inside

In keeping with tradition, this first issue of 1990 offers an ode to the previous year in the PC industry. Kicking off the new year is our tribute to the most technically innovative products of 1989 and the people behind them—the winners of our 1989 Technical Excellence Awards. "The Best of 1989" highlights the products that won the praise of *PC Magazine* editors. "Abort, Retry, Fail? Special Edition" is executive editor Bill Howard's look at the bizarre side of the PC industry.

We're also introducing a new tradition: the *PC Magazine* Endurance Tests. This new series explores how products hold up over the long haul. Endurance Test reviewers use the products in day-to-day office work for 6 to 12 months.

Until now, our cache of contributors and staff has spent two to four weeks investigating products. According to editor-in-chief and publishing director Bill Machrone, user groups also want to know how their investments will stand up over time. At the helm of the series is staff editor Jennifer Zaino, who explains, "The point of long-term, daily contact is to flush out the flaws and benefits that don't surface when you study products for only a few weeks."

Howard points out that "the ultimate cost of a product may be the cost of fixing it—even replacing it—if it breaks." With products in our grasp for half a year, we're examining manufacturers' service and support.

Products tested in the series include Editor's Choice and Technical Excellence winners and market leaders. For most, we've published the results of PC Labs benchmark tests in previous articles, which you'll find referenced in the reviews. The reviews are accompanied by a summary of our findings and a rating of reliability, compatibility, and performance.

Endurance Tests will appear throughout the year. In this first installment, we give the verdicts on nine 386 and on five portable computers.

—Ann Sherman ■

The long and winding road: staff editor Jennifer Zaino is overseeing *PC Magazine*'s Endurance Test series.

PHOTOGRAPHY: THOM O'CONNOR

In Memoriam

The staff of *PC Magazine* and all the members of its extended family at Ziff Communications are mourning the loss of two of our young editors, who died in the northern California earthquake.

Derek Van Alstyne and John Anderson were performing their duties as editors at *MacUser* magazine when the earthquake struck on October 17. They were caught in the collapse of a San Francisco building as they left the offices of a software publisher.

Derek, 22, was a bachelor who recently left *MacGuide* in Denver to join *MacUser*. John, 32, had been writing for Ziff-Davis magazines, including *Creative Computing* and *Computer Shopper*, since 1982. He is survived by his wife, Lauren, and two children.

PC Magazine: The Independent Guide to IBM-Standard Personal Computing, ISSN #0888-8507, is published biweekly except in July and August for $44.97 for one year (22 issues). Additional postage $1.41 per copy or $31.00 per year for Canada and all other foreign countries. Ziff-Davis Publishing Co., a division of Ziff Communications Co., One Park Ave., New York, NY 10016. Second-class postage paid at New York, NY 10016 and at additional mailing offices. POSTMASTER: Address changes to *PC Magazine*, P.O. Box 54093, Boulder, CO 80321-4093.

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"The QMS JetScript controller is the best way available to add PostScript capabilities to a Hewlett-Packard LaserJet Series II printer."

–PC Week
Sept. 19, 1988

Hewlett-Packard® and QMS® have made it easy to give your LaserJet Series II® the desktop publishing power of the PostScript® page description language.

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Impressive results People have come to expect impressive results from QMS—one of the first companies to bring the power of PostScript to laser printing, and now with more PostScript-based products than any other company.

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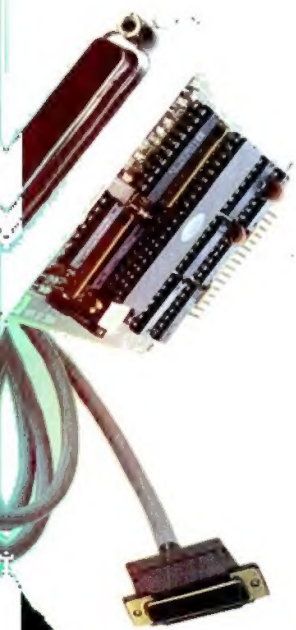
**JetScript available for IBM PC-XT™, IBM PC-AT™, HP Vectra™ and compatible personal computers, or the IBM PS/2™ Model 30.*



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January 16, 1990

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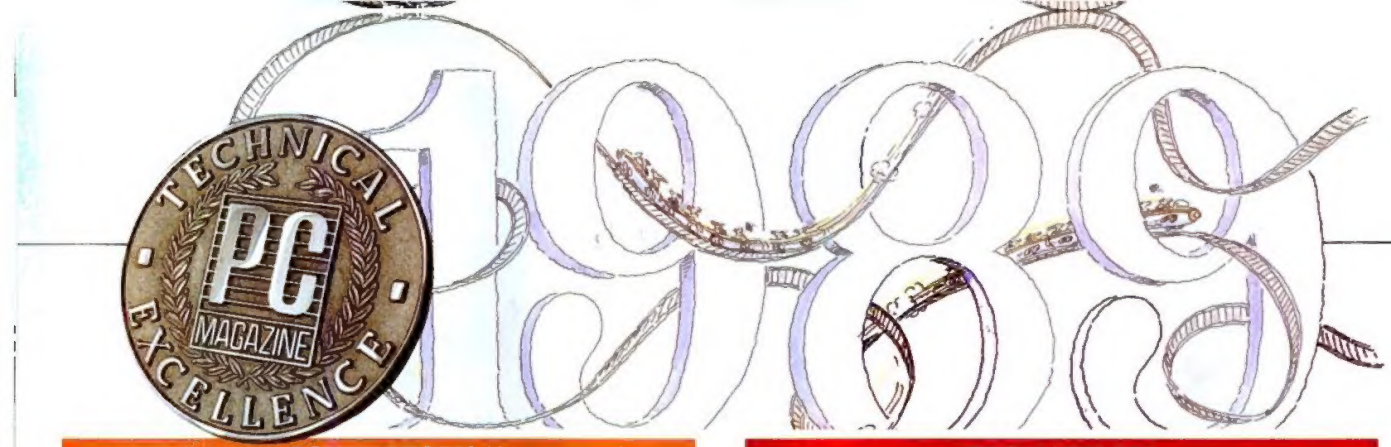

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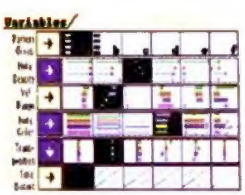

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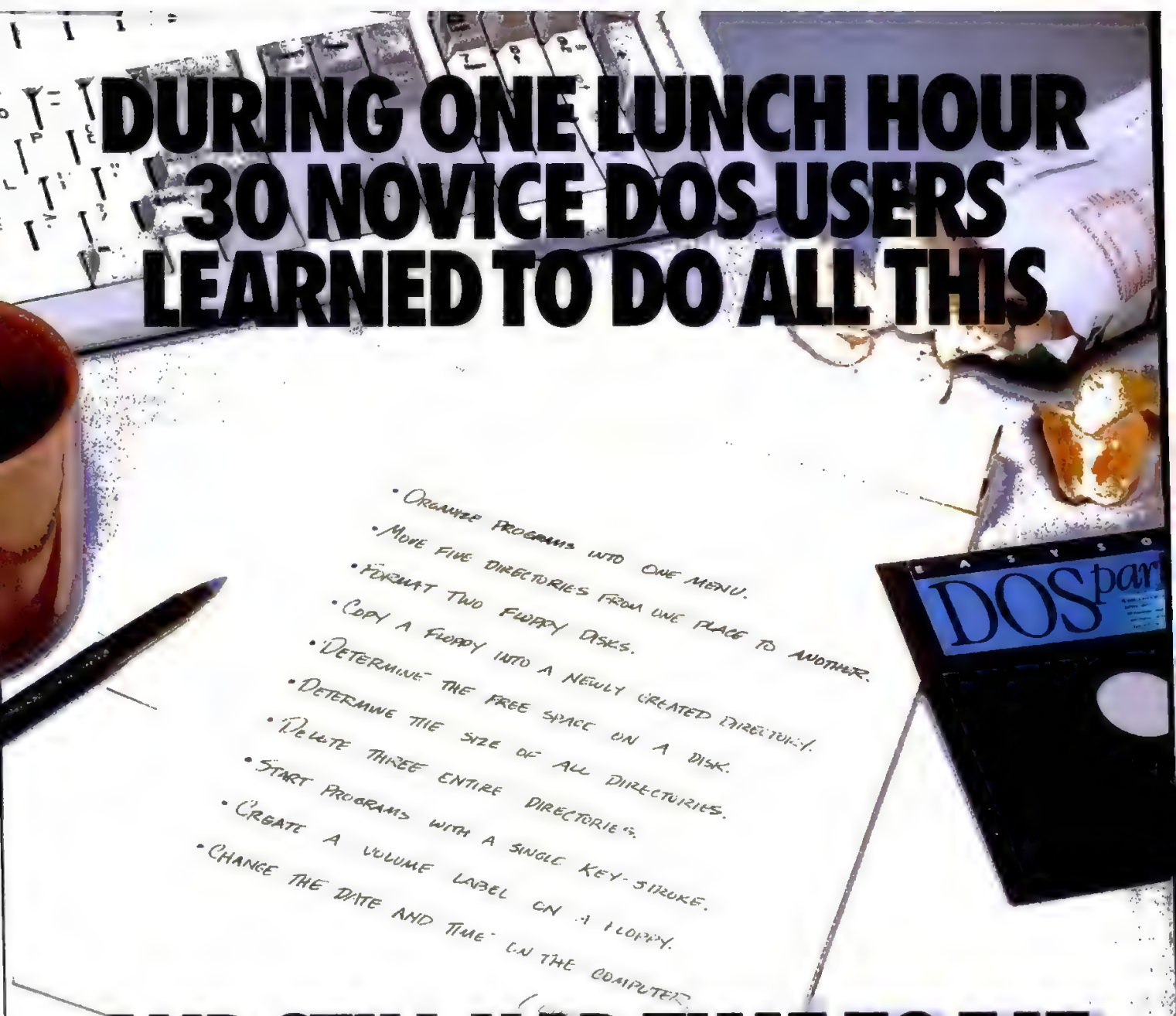

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E A S Y S O F T

CIRCLE 222 ON READER SERVICE CARD

Letters

BACK TO BASICS

Thanks for a great article by Ethan Winer on BASIC! ("BASIC, Yes; Feeble, No," *PC Magazine,* October 31, 1989). It's high time the computing world woke up to the fact that with the new BASIC compilers available, you can program just about anything on a PC. As a QuickBASIC user myself, I'm convinced that with a few assembler routines called at the right moments, you can create applications faster and easier in BASIC than you can in C, or any other language for that matter!

Bill Weiss
Paramus, New Jersey

Excellent, repeat, excellent article on BASIC. Congratulations to Ethan Winer and your other reviewers on a most comprehensive and informative effort.

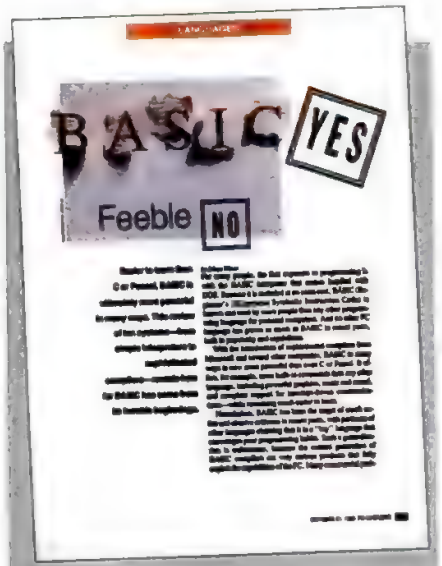
Charles Kolb
Newark, Ohio

HIGH PRAISE FOR LOW-END LAPTOPS

I was happy to *finally* see a comprehensive review of low-end, 8088-based laptop computers ("Lightweight Laptops," *PC Magazine,* October 17, 1989) and to see that you reviewed my recent laptop purchase, a Bondwell B200.

However, I feel that your refusal to give any of the reviewed machines an Editor's Choice award is nothing but a cop-out. You dismissed the entire collection of computers with the statement that users need at least a 286-based machine to "get the most out of" DOS-based applications. I am a writer, run *WordPerfect* on my laptop, and do not need the extra power you refer to. Many people like myself want the equivalent of a Tandy 102 that can run DOS at an affordable price. Please don't discount their needs, or the true utility of these machines. I know that I'll never want to run OS/2 or Presentation Manager on my lap and wouldn't waste my money on a machine that could.

[illegible]ombs
[illegible], Ohio



BASIC: still going strong after all these years.

Congratulations for having rediscovered the Bondwell laptop ("Lightweight Laptops"). Too bad you had to pick one of the company's newer, limited models to review, and not one of its older machines.

Laptops are the future of microcomputing and the desktop will suffer the same "dinosaur" fate as the minicomputer. As your writers point out, technology will bundle, on plug-in chips, many of the functions currently provided on large add-in cards. Furthermore, we'll see more in the way of programs on credit-card-size media, storage in nonvolatile RAM, and micros with no moving parts. It won't be long before all users will take their micros with them—the same way they do with calculators—and plug the PCs into docking stations or networks.

Allen A. Adams
Calgary, Alberta
Canada

I am writing about a trend that *PC Magazine* has followed for some time now; a trend that, judging by the number of letters you publish that address it, offends at least a few readers. That is your belief that every computer user wants to have the latest, fastest, most powerful, and most expensive computer available, and then will equip it with all the bells and whistles possible.

A good example of this is the rating of the 8088-based laptops ("Lightweight Laptops"). In all, relatively few positive comments were made about any of the machines reviewed. It seemed as if they were all being compared with 386 machines instead of with each other. The reviewers seemed to have forgotten that these laptops are aimed at a specific segment of the market, a segment that is not in the least bit interested in having a state-of-the-art PC.

Several times in the article, the reviewers made comments implying that the users of these low-end machines use them because they cannot afford the faster 286 or 386 laptops. Has it ever occurred to the reviewers that there are plenty of us out here who *can* afford the more costly machines but just don't want, or need, the extra speed and expense?

Michael E. Lauman
Richland, Washington

CASE STUDY

I look forward to receiving each copy of *PC Magazine,* and I generally keep my issues for two years as reference. I'm hoping that you'll take on, in your usual thorough manner, a comparison of CASE software, as, frankly, the manufacturers' claims all sound too good to be true! Personally, I'm thinking of purchasing a number of packages that are advertised in the pages of *PC Magazine,* but as of yet, I haven't seen any reviews or articles on the subject.

John R. Sharnik
Stamford, Connecticut

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CIRCLE 316 ON READER SERVICE CARD

Letters

CLIP FIGURES

Your recent roundup of clip-art packages was excellent ("PC-based Clip Art: Instant Images," *PC Magazine*, October 17, 1989). However, you seem to have missed one vital benchmark that would have made the reviews much more helpful: how each program illustrates the human form.

We've found over the years that packages of printed clip art often suffer terribly in their sadly obvious inattention to facial detail and anatomy. And unfortunately, the same seems to be true of computer graphics. Yet on page 216, the caption given for the examples of the *Micrografx ClipArt Libraries* misses the point entirely, noting only that one of the illustrations

Plenty of us can afford the more costly machines; we just don't want them.

prints poorly. But—ye gods!—just look at the two profiles of the women. They're grotesque!

A follow-up piece on how these clip-art packages reproduce human beings—as people or as mutations—would be a real service to those of us who are interested in more than just inanimate objects.

Bob Arlow
Thousand Oaks, California

DVORAK CALLED IT

As a computer consultant, it's my job to help clients sort through all the hype and give them products that work. *PC Magazine* has greatly aided me in this regard. In fact, John Dvorak's column in the October 17, 1989, issue, in which he addressed compatibility, hit the nail right on the head. It's guys like him that help add some degree of stability to an otherwise very unstable industry.

I, too, sweated through the same problems with *Lotus 1-2-3*, Release 3, and the fact that the software was tested thoroughly only on IBM and Compaq computers is nothing more than a consumer ripoff. I finally got the package to work after changing the BIOS on two machines and adding a set command on boot-up. After the program was running, I was somewhat impressed by its capabilities, but my first impression still sticks like glue. I'm certainly glad I wasn't on a job site playing trial-and-error with this software; I would have significant trouble sleeping at night if I charged a client for 8 hours' time to install a single spreadsheet package. It is equally difficult, furthermore, to tell a client who has just shelled out for a new 386 that we will have to change the BIOS and the keyboard in order for him to run *1-2-3*.

Mike Sporer
Scranton, Pennsylvania

UNITASKING?

John Dvorak didn't need to convince me that multitasking my IBM compatible just won't cut it (John C. Dvorak, *PC Magazine*, September 26, 1989). I've given up on the idea of reliably running more than one MS-DOS application at a time (not counting TSRs like *PC Tools Deluxe*, *Mirror III*, and so on). It's too bad, because I don't have room in my tiny home office for another PC.

No choice, then, but to continue running MS-DOS applications in a window on my multitasking Amiga.

Ron Legro
Milwaukee, Wisconsin

Until recently, I was an avid fan of John Dvorak; the man provided a lot of entertaining (useless, but entertaining) speculation in his columns. Now, however, in suggesting that multitasking is best performed by two separate machines, Dvorak has become dangerous.

I am the proud owner of an AT clone and would give almost anything I can think of to just get the chance to do some true multitasking (like we were promised with the 286 chip). I can only hope that other readers do not take Dvorak's comments very seriously, as I would hate to see the concept of multitasking drop to some obscure level because one man was able to influence a large number of users against it.

Robert McAdams
Dallas, Texas

A KINDER, GENTLER MACRO

I've read—and reread slowly—Rubenking's explanation of usi... *WordPerfect* macro programming... (Lab Notes, *PC Magazine*, O...

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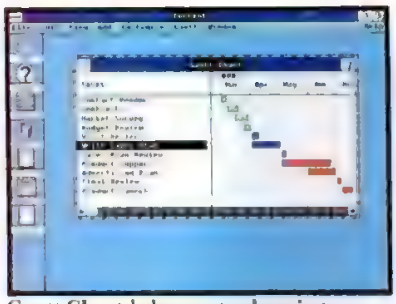
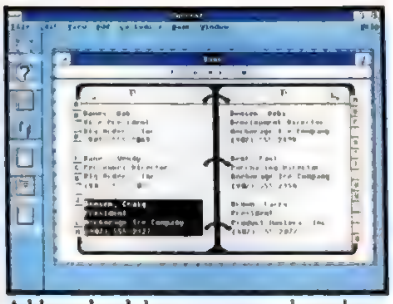
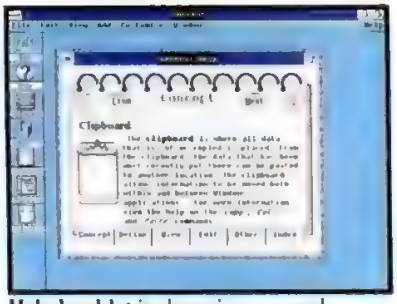
PROJECT BOARD



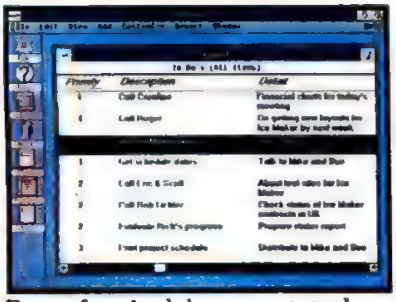
Gantt Chart helps you track projects, manage time.



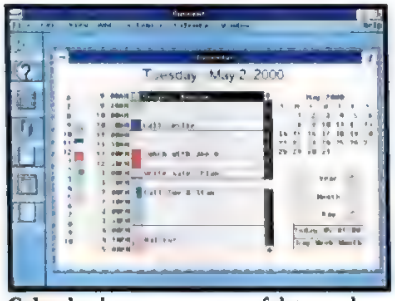
Address book keeps names and numbers at your fingertips.



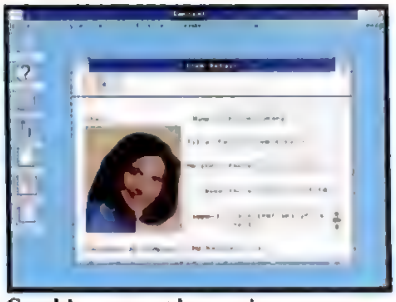
Help booklet is always in your reach.



Report function helps you create to-do lists and print professional-looking reports.



Calendar keeps you on top of dates and appointments, lets you view any day, week or month at a glance.



Graphics support lets you incorporate graphics and photographs wherever they're needed.

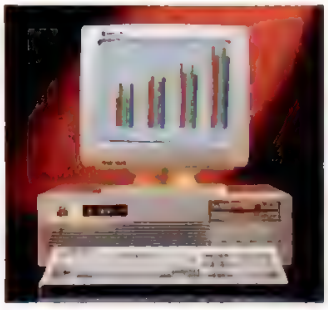
Introducing IBM Current. For businesspeople who really have their hands full.

The busier you are, the harder it is to keep track of your work, your appointments, your whole life. Especially when everything is constantly changing.

But now, there's Current from IBM: the PC software package instantly. No more sifting through the roll of out-of-date cards on your desk for answers. There's even a Gantt chart that tracks all your tasks at once, and spots potential time conflicts before they happen. Plus, you can customize IBM Current to your

QUALITY BY DESIGN

PC WEEK reports that PC Designs dominated the CORP COMPUTER POLL, receiving top marks in four categories:
1.-Compatability with hardware and software 2.-Relative Performance 3.-Ease of Installation 4.-Ease of Configuration



GV286/120

- 80286 running at 12 MHz zero wait state.
- Proprietary, 32KB on-board RAM cache circuit using high speed (35ns) static RAM.
- 512KB RAM, expandable to 1MB on motherboard.
- Socketed for 8MHz 80287 math coprocessor.
- 5.25" 1.2MB or 3.5" 1.44MB floppy drive.
- Enhanced 101-key keyboard.
- Graphics adaptor features a full 256K of video RAM and 16-bit interface for full VGA capabilities on VGA Color System.
- 200-watt power supply.
- 2 serial/1 parallel port standard (on add-in card).
- ROM based set-up and diagnostics.
- Motherboard designed and manufactured in the U.S.A. by PC Designs.
- Toll-free technical support.
- On-site Service for one year.

PC MAGAZINE EDITOR'S CHOICE Oct 13, 1987

GV386/25

- 80386 running at 25 MHz zero wait state.
- 2MB RAM on motherboard.
- System is capable of expanding to 16 MB of 32-bit RAM.
- Proprietary, 64KB on-board RAM cache circuit using high speed static RAM.
- Socketed for 25 MHz Intel 80387, or 25 MHz Weitek 3167 math coprocessors.
- 5.25" 1.2MB or 3.5" 1.44MB floppy drive.
- 2, 8-bit, 5, 16-bit and 1, 32-bit memory expansion slots.
- Graphics adaptor features a full 256K of video RAM and 16-bit interface for full VGA capabilities on VGA Color System.
- 2 serial/1 parallel port standard (on add-in card).
- ROM based set-up and diagnostics.
- Motherboard designed and manufactured in U.S.A. by PC Designs.
- Toll-free technical support.
- On-site Service for one year.

GV386/20 PLUS

- 80386 running at 20 MHz zero wait state.
- 1MB RAM on motherboard.
- System is capable of expanding to 16 MB of 32-bit RAM.
- Proprietary, 64KB on-board RAM cache circuit using high speed (35ns) static RAM.
- Socketed for 20MHz Intel 80387, or 20MHz Weitek 3167 math coprocessors.
- 5.25" 1.2MB or 3.5" 1.44MB floppy drive.
- 2, 8-bit, 4, 16-bit and 2, 32-bit memory expansion slots.
- Graphics adaptor features a full 256K of video RAM and 16-bit interface for full VGA capabilities on VGA Color System.
- 2 serial/1 parallel port standard (on add-in card).
- ROM based set-up and diagnostics.
- Motherboard designed and manufactured in U.S.A. by PC Designs.
- Toll-free technical support.
- On-site Service for one year.

PC MAGAZINE "Overall, PC Designs' latest effort effectively integrates brand-name components and a proprietary motherboard to yield generally swift and solid performance. If you're in the market for a 386, this sytem is worth a look."
— PC MAGAZINE — May 30, 1989

GV386SX

- Run 32-bit operating systems, applications software, or Windows 386 at a lower cost.
- Slim-line, space-saving desktop configuration.
- 80386SX running at 16 MHz zero wait state.
- 2MB RAM standard, 4MB capacity on motherboard.
- Socketed for 16MHz Intel 80387SX, math coprocessor.
- 3.5" 1.44MB floppy drive.
- VLSI technology for increased reliability.
- Graphics adaptor features a full 256K of video RAM and 16-bit interface for full VGA capabilities on VGA Color System.
- 2 serial/1 parallel port standard (on add-in card).
- ROM based set-up and diagnostics.
- Motherboard designed and manufactured in U.S.A. by PC Designs.
- Toll-free technical support.
- On-site Service for one year.

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OPTIONS GV286/120

- RAM upgrades.
- Intel 80287 math coprocessor.
- MS-DOS 3.3. or 4.01.

OPTIONS GV386/25

- RAM upgrades.
- Intel 80287 math coprocessor.
- MS-DOS 3.3. or 4.01.

OPTIONS GV386/20 PLUS

- RAM upgrades.
- 20MHz Intel 80387 and 20MHz Weitek 3167 math coprocessors.
- MS-DOS 3.3. or 4.01.

OPTIONS GV386SX

- RAM upgrades.
- 16 MHz Intel 80387SX math coprocessors.
- MS-DOS 3.3. or 4.01.

Letters

1989), and I'm pretty sure I've finally got a handle on it.

The trouble is, the vast majority of us who use this or any other word processor basically view the package not as a programming environment but as a high-tech typewriter for creating letters, proposals, scripts, or books. And while powerful, the macros are useful only as tools to semi-automate some of that typewriter's features, especially the more repetitive or function-key-intensive ones.

So instead of showing us how to MPL our way to a pretty, but empty, multicolor pop-up window, why not make the examples a bit more useful? Perhaps you can show us how to pop up a window that offers easily selectable choices of printer, paper size, text quality, and manual or continuous paper feeds.

Bill Stoller
Brooklyn, New York

READER SERVICE

Last year, I bought the Okidata Laserline 6 laser printer based on your favorable product review in the 1987 printer blockbuster (*PC Magazine*, November 10, 1987). Lately, my printer has been producing smears and shadows and last week the drum kit died about 9,000 copies before it should have. By happenstance I spotted your sidebar in the October 31, 1988, issue of *PC Magazine* ("When Bad Things Happen to Good Printers," p. 114), mentioning similar widespread problems and Okidata's correction of the trouble and support for early purchasers like me. I contacted the company and its technical support staff promptly took care of the matter to my complete satisfaction.

Kudos to *PC Magazine* for its follow-up service to readers who take its advice, and kudos to Okidata for correcting a problem that perhaps wasn't even its fault, as the drums used in the Okidata were manufactured by Ricoh.

Ken Sides
Tampa, Florida

ON-THE-JOB TRAINING

I want to take this opportunity to thank *PC Magazine*, its editors, writers, and contributors for all the excellent articles, programs, and commentaries. I have been reading the magazine for the last few years, and it is safe to say that I have progressed from computer neophyte to "office guru" solely on the basis of the features, reviews, and programming tips that have appeared within the pages of each issue. Please keep up the excellent work.

Mike Manson
Fremont, California

John Dvorak didn't need to convince me that multitasking my PC won't cut it.

BRIGHT LIGHTS, NEW FORMAT

About the new format for the magazine: I really like the look of it, but perhaps the colors are a bit much? Might I suggest that in addition to utilities disks for new subscribers, you also send them a pair of sunglasses.

Charles J. Goulet
Warsaw, New York

CORRECTIONS & AMPLIFICATIONS

Contrary to the features table, *Microsoft Word* ("Two Aces and a King: The Big Three Word Processors Raise the Ante," *PC Magazine*, November 28, 1989) does indeed have the ability to print a defined block of text.

In the September 26, 1989, New & Improved column, it was stated that *BackLoader 2*, from Roxxolid Corp., deletes the most recently used font to make room for a new one when the printer runs out of memory. In fact, the package deletes the least recently used font. Furthermore, the upgrade from *BackLoader 1* is not available free of charge, but for $59.05.

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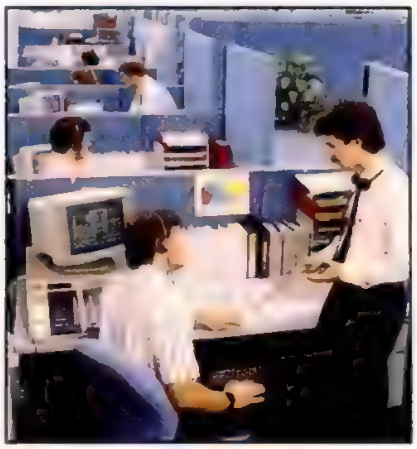

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"I can safely say that the technical support staff that you have has done a job above and beyond the call of duty. Thanks for a good product and especially good service after the sale." — Gary M. Wolfe, President, Pioneer Financial Services, Kingston, TN

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"Tussey's Swan 386/20 flies."
— Computer Shopper, April 1989
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386/20	VIDEO OPTIONS			
Drive Options	Mono	14" Flat Mono	VGA Mono	VGA Color
w/ 48MB (28ms) & 1:1 Interleave	$2099	$2148	$2299	$2599
w/ 80MB (28ms) & 1:1 Interleave	$2449	$2498	$2649	$2949
w/ 150MB (18ms) ESDI & 1:1 Interleave	$3099	$3148	$3299	$3599

Vertical Case Option for 386/20 w/230W Power Supply add $300

Swan 386SX

"Tussey's entry comes in first for expandability and low price, and it still turns in respectable times"
— PC Week, Apr. 10, 1989

$1199

Base System with Single Floppy, No Video

386SX	VIDEO OPTIONS			
Drive Options	Mono	14" Flat Mono	VGA Mono	VGA Color
w/ 32MB (28ms) & 1:1 Interleave	$1599	$1648	$1799	$2099
w/ 48MB (28ms) & 1:1 Interleave	$1699	$1748	$1899	$2199
w/ 80MB (28ms) & 1:1 Interleave	$2049	$2098	$2249	$2549
w/ 150MB (18ms) ESDI & 1:1 Interleave	$2699	$2748	$2899	$3199

Standard Features	386/20	386SX	286/12	XT10
CPU	80386	80386SX	80286	8088-1
Speed (MHz)	20/8	16/8	12.5/6.25	10/4.77
BIOS	Phoenix	Phoenix	Phoenix	Phoenix
Norton SI Rating v 4.0	22.0	17.6	12.3	2.1
Standard Memory	1MB	1MB	512K	640K
Shadow BIOS	384K	Yes	Yes	
Memory Upgrades	2, 4, 8, 16, 32MB	2, 2.5, 6, 8MB	640K, 1, 2, 3, 5MB	—
Coprocessor Support	80287 or 80387	80387SX	80287	8087
Expansion Slots 32-bit	1			
Expansion Slots 16-bit	4	6	6	
Expansion Slots 8-bit	3	2	2	8
Dual HD FD Controller	Yes	Yes	Yes	w/ HD w/ Adapter
5.25" Floppy Drive	Your Choice	Your Choice	Your Choice	Standard
3.5" Floppy Drive				Optional
Device Bays (Internal/External)	3 Exp., 2 Int.	3 Exp., 2 Int.	3 Exp., 2 Int.	2 Exp., 2 Int.
Serial Ports	2	1	1	1
Additional I/O Ports	1 Parallel	1 Parallel	1 Parallel	1 Par/1 Game
Power Supply	200W	200W	200W	150W
Keyboard (Touch & Click or Silent)	101 Key	101 Key	101 Key	101 Key
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Operating System	MS-DOS & GW BASIC add $89			
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Swan 286/12

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— PC Magazine, Sept. 12, 1989
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286/12	VIDEO OPTIONS			
Drive Options	Mono	14" Flat Mono	EGA	VGA
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w/ 80MB (28ms) & 1:1 Interleave	$1349	$1398	$1699	$1849
w/ 80MB (28ms) & 1:1 Interleave	$1699	$1748	$2049	$2199

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XT10	VIDEO OPTIONS			
Drive Options	Mono*	CGA	EGA	VGA
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*w/ 32MB (40ms) Hard Drive	$929	$1,079	$1,279	$1,379

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1524 (240cps, 132 col, 24-pin)	$569
1624 (192cps, 132 col, 24-pin)	$Call
4450 (11ppm laser printer)	$1375

EPSON

LX-810 (180 cps, 80 col, 9-pin)	$189
FX-850 (264cps, 80 col, 9-pin)	$Call
FX-1050 (264cps, 132 col, 9-pin)	for
LQ-510 (180cps, 80 col, 24-pin)	Best
LQ-850 (264cps, 80 col, 24-pin)	Price
LQ-950 (264cps, 110 col, 24-pin)	on
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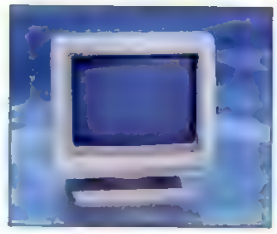

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Packard Bell with tilt/swivel Amber or Green	$99
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Swan Monochrome SW525	$89

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Magnavox 8515	$289
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Swan RGB	$219

EGA

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Magnavox 9053	$359
Packard Bell 1431	$349

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Mitsubishi Diamond Scan	$499
NEC Multisync 3-D 14"	$679
NEC Multisync 4-D/5-D	$Call
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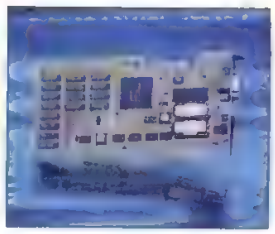

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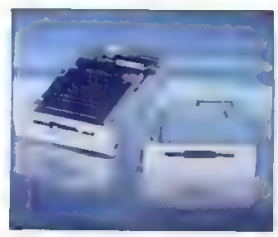

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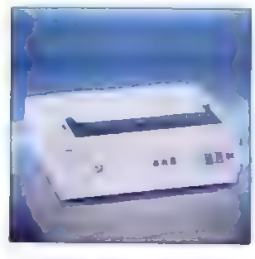

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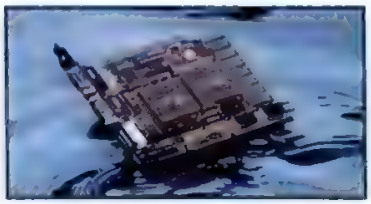

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Advisor

WORDS FOR THE COMPUTER-WISE

Is there an updated dictionary of all the new computer terms that have cropped up since I graduated from my "What's a processor?" days?

Preston Lockwood
Salt Lake City, Utah

I know of a book that is good—although incomplete—that should provide you with 90 percent of all the definitions you need.

I have found Alan Freedman's *The Computer Glossary*, fourth edition ($24.95; ISBN 0-8144-7709-7; The Computer Language Co. Inc., Point Pleasant, PA 18950; (215) 297-8082), to be invaluable. As well as providing definitions, it talks about the companies and programs that are major players in the industry. It also provides technical information, such as the pin-out arrangement of the RS-232 interface.

In addition, the book lists acronyms according to the way they sound; for instance, if you look up *scuzzy*, it will refer you to the entry for SCSI.

One problem that I have run into is that most computer dictionaries haven't been updated since the mid-1980s, and the industry has changed quite a bit since that time. Even Freedman's book, the most recent I could find, was last updated in 1988, which means that the information it contains dates to 1987.

BACKGROUND FORMATTING

Do you know of any software that will format my floppies in the background? I'm really tired of having to stop work just to watch DOS's slow track and sector counts.

Dot Smith
Chicago, Illinois

If you're a PC MagNet or CompuServe member, you can download Sydex's *Con>Format*, a $15 shareware TSR utility that provides background formatting at the touch of a hotkey, from data library 2 of UTILFORUM (filename: CONFMT.ARC) (153 N. Murphy Ave., Sunnyvale, CA 94086; (408) 739-4866). When resident, the program takes up about 11K of RAM.

- WORDS FOR THE COMPUTER-WISE: A dictionary of computer terms.
- BACKGROUND FORMATTING: Getting on with your work while your floppies format.
- FROM VGA TO VIDEOTAPE: Recording your VGA screens onto videocassettes.

A nonshareware offering is *Floppy Driver*, distributed by DTG ($89.95; 23704-5 El Toro Rd., #348, El Toro, CA 92630; (213) 987-2000). In addition to providing background formatting, *Floppy Driver* can also speed up the operation of your floppy disk drive, although it takes a while to get used to the sounds that begin to emanate from the drive.

A review of *Con>Format* appears on page 48 of First Looks in the June 27, 1989, issue of *PC Magazine*.

FROM VGA TO VIDEOTAPE

Our company wants to create customized computer video training tapes, and we are looking for a way to record computer screens to VHS or Super VHS tape. We will be using EGA or VGA boards, and want to use genlocking to enhance our videos. Do you have any suggestions of where we might start looking for the necessary hardware?

Craig Beaurline
Chicago, Illinois

You're not alone; this is one of the most frequent questions I get. TVs and VHS machines conform to the National Television Standards Committee specification RS-170A—commonly referred to simply as NTSC—which differs from EGA and VGA video in a few ways. First, an NTSC signal is a *composite:* the red, green, and blue signals are combined with another signal that gives the video output device synchronization information. The sync signals keep the display from, say, starting the picture in the middle of the top line of the display rather than in the upper-left-hand corner.

Although EGA video is composite, which is why you occasionally see EGA cards with RCA output jacks, it operates at a different frequency than a TV or VCR; VGA signals need to be combined as well as synchronized. A device that combines the signals and converts the frequencies is called an *encoder*. When you want to combine images from two different sources, such as overlaying computer-generated text or graphics on top of input from a video camera, you need a *generator locking device*, or *genlock*. A genlock basically locks one set of sync signals while it accepts feed from another source. For instance, it holds the words *Susie's First Birthday* in place while you record Susie smearing herself with chocolate cake.

Keep in mind that even though it's interlaced and has relatively low resolution, TV looks as good as it does because it uses simultaneous colors; more colors fool the eye into thinking that the image is higher resolution because it's easier to "fill in the blanks." Recording onto videotape further degrades the quality of the image.

There are several products on the market that will do what you want, but each is differentiated enough from the others that if you have very specific needs, you really have little choice.

If you've already got a VGA board that you'd like to keep in your system, your

only option at the moment is Magni Systems' VGA Producer board ($1,695; 9500 SW Gemini Dr., Beaverton, OR 97005; (800) 237-5964, (503) 626-8400). VGA Producer plugs into the 28-pin RAM DAC (digital-to-analog converter) socket on your VGA card and takes up a full-size 8-bit slot in your machine. Unfortunately, the RAM DAC chip on many VGA cards is soldered in rather than socketed, so you may not be able to avail yourself of this option.

If your hardware allows it, however, VGA Producer performs encoding and genlocking and supports both regular VHS and Super VHS. (S-VHS provides higher-quality video than standard VHS because it separates the *luminance*, or brightness information of the signal, from the *chrominance*, or color information. Since the signal is different, it requires different encoding.)

For EGA-equipped systems, Progressive Image Technology offers the Video EGA, also known as Video Charley ($749.95; 120 Blue Ravine Rd., #2, Folsom, CA 95630; (916) 985-7501), an encoding, genlocking daughterboard that plugs into the feature connector of your EGA card. The company plans to offer a VGA-compatible version, Video VGA, by the beginning of 1990. Neither board supports S-VHS.

If you'd like to move the device around from one VGA-equipped machine to another and are willing to forgo genlocking, Jovian Logic Corp.'s VIN ($395; 42808 Christy St., #230, Fremont, CA 94538; (415) 651-4823)—VIN stands for VGA Into NTSC—performs encoding and supports both types of VHS.

There are also boards that combine VGA and NTSC output on one card, such as U.S. Video's Recordable VGA ($799; One Stamford Landing, 62 Southfield Ave., Stamford, CT 06902; (203) 964-9000) and Willow Peripherals' VGA-TV ($699; 190 Willow Ave., Bronx, NY 10454; (212) 402-0010). VGA-TV offers the least expensive combination of video and encoding, but it provides the fewest capabilities of all the aforementioned products, offering merely NTSC and analog output. The Recordable VGA doesn't offer on-board genlock, but U.S. Video does have a $399 add-on module that makes it genlock-capable.

Last, but not least, is Truevision's Targa 16 ($1,995; 7340 Shadeland Station, Indianapolis, IN 46256; (800) 858-8783, (317) 841-0332), which lacks VGA compatibility (it has a resolution of 512 by 482) but offers over 32,000 simultaneous colors in exchange. The board genlocks but does not support S-VHS.

Each of these products has other features that may influence your decision; I hope I've at least offered you a start. For more information about VGA Producer, see page 43 of First Looks in the November 28, 1989, issue of *PC Magazine*. Discussions of the Willow and Targa boards are in the visual sidebar "Two Willow Cards ≤ One Targa" on page 158 of the July 1989 issue.

ASK THE ADVISOR

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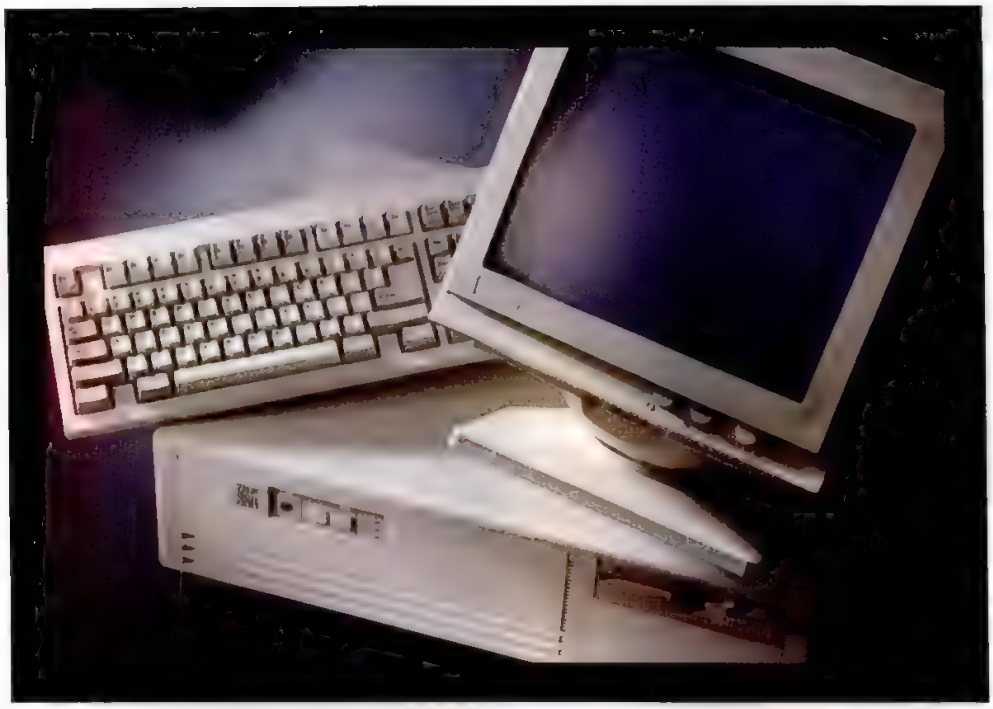

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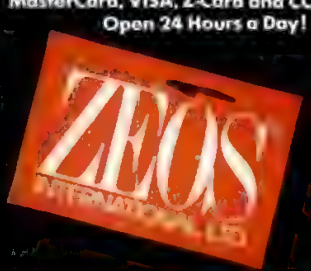

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First Looks

Hands-on Reviews of the Latest Products

IBM Audio Visual Connection Combines TV-Quality Images, Stereo Sound, And Information Management

HANDS ON
by Frederic E. Davis

The IBM Audio Visual Connection (AVC) is a combination software/hardware product that can be used to create dazzling business presentations or complex multimedia databases. The AVC system brings television-quality color images, high-fidelity digital sound, and a multimedia authoring system to the personal computer for the first time. Owning the AVC is like having a digital tape recorder, a sound mixer, and several slide projecters and dissolve units all wrapped into a single PC.

The AVC consists of a software package and two optional add-in boards. One of the boards, the Video Capture Adapter (for the MCA bus), allows you to capture and save full-color images (65,536 colors) at TV-quality resolutions and convert them into formats that can be viewed at common monitor resolutions that support 256 colors.

The other board, the Audio Capture and Playback Adapter, allows you to capture, save, and play back two channels of digitally recorded sound. Versions of the board are available for the MCA bus and AT-style buses.

The complex but powerful AVC software includes an authoring system and custom programming language for creating presentations and databases. The AVC software allows you to edit and manipulate the color images captured by the video board (or imported from other programs) and create a story-

CONTINUED ON PAGE 34

The AVC can condense a 65,536-color TV-quality image into a format displayable on a 256-color monitor.

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Amí Professional: The First Graphics-based Challenge to Character-based WPs

HANDS ON
by Edward Mendelson

If you expected the new *Microsoft Windows*–based word processors to be long on what-you-see and short on what-you-get, prepare to be surprised by *Amí Professional*. Samna Corp.'s $495 graphics-based package sports a variety of capabilities, customizations, and conveniences that rival—and often exceed—those of the most advanced character-based word processors.

Features are worthless if they take weeks to learn and hours to use. The features in *Amí Professional* are both intuitive and fast. Once you understand the basic concept of a style sheet, you can create and modify document formats through menus that show you the effects of your choices, before you return to the document itself. As you select fonts or paragraph formats, the program displays samples on the same menu so that you don't have to guess at the result.

Although the program is inevitably hobbled by the sluggish *Windows* environment, it feels subjectively faster than almost any other *Windows* application that works with text. If you don't burden a paragraph with multiple fonts, the screen will keep pace with your typing. Many functions in *Amí Professional* running under *Windows* feel subjectively faster than similar features in *DeScribe* running under Presentation Manager. And if you aren't satisfied with the high speed of *Amí Professional*'s WYSIWYG screen, you can create text in a draft mode that doesn't show the final layout.

The designers of *Amí Pro-*

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PHOTOGRAPHY: THOM O'CONNOR

Ami Professional

CONTINUED FROM PAGE 33

fessional evidently spent a lot of time studying *WordPerfect* and *Microsoft Word* in order to incorporate their best features and add improvements of their own. *Ami Professional*'s paragraph styles can include boilerplate text, bullets, and automatic numbering. The program has line numbering and outline numbering (but no collapsible headings). It lets you create forms with "protected" text that you can't access with the mouse, to make it easier to reach the blanks that you want to fill in.

The program also offers hidden notes and bookmarks for finding your way around your documents, as well as a file manager for finding your way around your disk. Its spelling checker can automatically correct a misspelled word throughout a file, and its thesaurus offers brief definitions.

Everything about the screen is customizable. You can even choose your own set of icons to use on the menu bar. If you often use the charting feature, add a chart icon. If you use subscripts, add a subscript icon. If you're indecisive, add an undo icon. You can assign paragraph styles to function keys and hide or display vertical and horizontal rulers and various status lines and indicators. You can even specify the format for negative numbers in spreadsheet data—or make negative numbers print in red on a color printer.

Ami Professional imports graphics in .PCX, .TIF, .PIC, .EPS, and *Windows* Metafile formats, in addition to any bitmap copied via the *Windows* Clipboard. All graphics can be sized and rotated. The contents of *Lotus 1-2-3* .PIC files can be edited using *Ami Professional*'s drawing tools, which let you create arcs, polygons, and polylines. A TIFF editor lets you modify gray-scale images to adjust contrast and smooth or enhance edges. This is an extraordinary feature in a DOS word processor: Interleaf has included a similar gray-scale editor in its Unix workstation version, but it can't fit one into its DOS version—which requires 2MB of RAM.

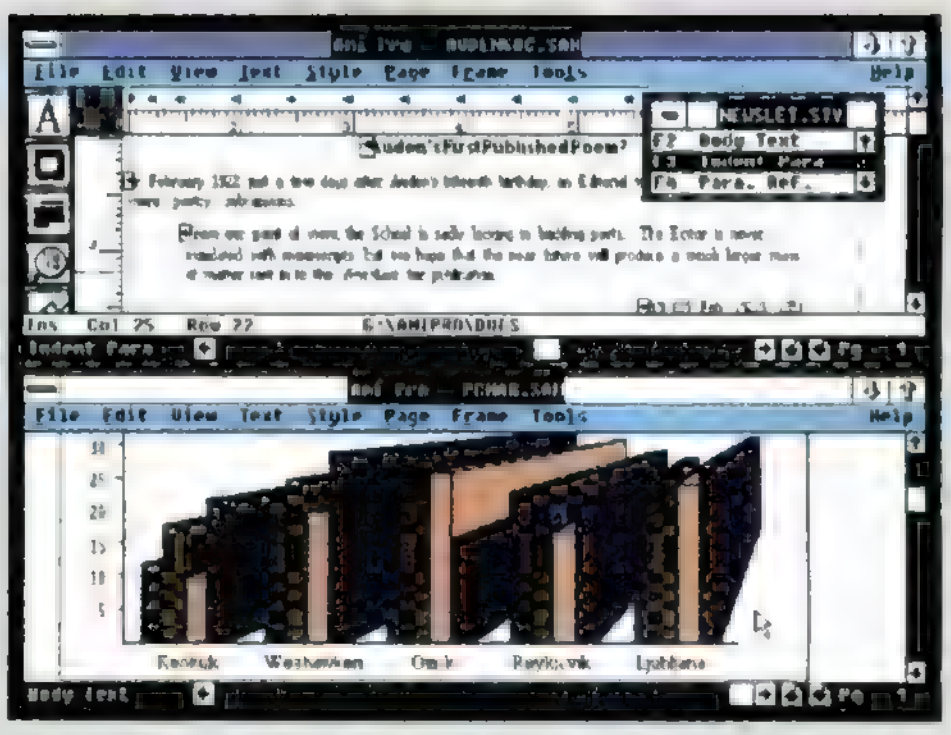
A flexible charting function offers 54 varieties of charts, most with options for 3-D or perspective effects. You can type charting data directly into a window, import it via the *Windows* Clipboard, or link the chart to data from other *Windows* applications (such as *Microsoft Excel*) that support DDE (dynamic data exchange). Dynamic links to chart data, text, or spreadsheets are updated automatically if both documents are open at the same time. *Ami Professional* can also import .DIF, *Lotus*, *dBASE II* through *IV*, *Enable*, and *SuperCalc* files without creating links. With varying fidelity to the original formats, it can import files from *Microsoft Word; MultiMate; WordPerfect*, Versions 4.2 and 5.0; *WordStar;* and *WordStar 2000*. *Word* style sheets are imported intelligently, although I found that paragraph formats sometimes got lost in translation.

You may not bother importing data from other programs when you discover how much *Ami Professional* can do on its own. It creates tables of contents, indexes, and lists; its flexible sort function lets you customize the field delimiter; its footnote function lets you customize the line that separates text and footnotes. Timed backup lets you experiment with impunity. Mail-merge is both straightforward and moderately programmable.

Keystroke macros can be assigned to keys or played back by title. A box on the warranty card brings you a printed version of an on-disk macro manual that helps you edit advanced macros that can call on DDE links to other applications.

Ami Professional survived virtually all of the ordeals to which I subjected it. It had no trouble handling files of 50 pages or more, and even reformatted them quickly. The program occasionally took two tries to import data from *Excel* or, oddly, to get a format change to take. In some charts, the optional legend came perilously close to overwriting crucial details on the chart itself, and the program's ambitious effort to import *Word* styles sometimes faltered. But these are trivial blemishes on one of the most ambitious programs introduced this season.

The original, less powerful *Ami* is still available for $199, with a $100 rebate coupon for purchasers of *Ami Professional*. This latest version is a spectacular achievement by any standard. Microsoft's forthcoming *Word for Windows* suddenly faces a formidable challenge. ■



Ami Professional **lets you split the screen and open two files at once, with different options in each window. The style bar at the left of the upper window is fully customizable.**

FACT FILE

Ami Professional
Samna Corp., 5600 Glenridge Dr., Atlanta, GA 30342; (404) 851-0007.
List Price: $495.
Requires: 640K RAM; hard disk; 80286- or 80386-based computer; Hercules, CGA, EGA, or VGA graphics card; includes a runtime version of *Microsoft Windows*, DOS 3.0 or later.
In Short: A surprisingly powerful, intuitive, and customizable WYSIWYG word processor for *Microsoft Windows*, with most of the features of the best character-based word processors and advanced graphics and charting functions.

CIRCLE 442 ON READER SERVICE CARD

IBM AVC

CONTINUED FROM PAGE 33

board for the presentation. You can add dissolves, fades, and other special effects to your presentation.

The software also lets you edit the two-channel stereo soundtrack and combine it with the video portion of the presentation. The clever, graphically rich on-line help system guides you through the many complexities of the software and shows off the system's data-handling capabilities.

The software's built-in programming facility is called the Audio Visual Authoring (or AVA) language. AVA not only provides the programming functions necessary for manipulating images, text, and sound, but it also has enough commands and operators to create structured programs that tackle tasks such as data manipulation, file management, and communications with a host minicomputer or mainframe.

AVA allows you to tap many of the system's powerful capabilities, among them integrating images and sounds with database functions, hypertext-like linking of the elements in a database or presentation, and linking the multimedia information created with the AVC to external databases or programs. AVA also lets you integrate AVC presentations with exter-

nal applications via either the C programming language or *KnowledgeTool*, a mainframe/mini-based IBM expert system.

The Audio Capture and Playback Adapter is a digital signal processor (DSP) board built around the TMS320C25 DSP chip made by Tecmar for IBM. The board has two input connectors (Stereo Line and Mono Mic) and two output connectors (Stereo Line and Headphone).

The board allows you to record and play back sounds in three modes: Voice Quality, Music Quality, and Stereo Quality. Voice Quality mode is recorded at a low sampling rate that is adequate for voice recording but a bit fuzzy for music; it requires 5.5K of memory for each second of recorded sound.

Music Quality is recorded at twice the sampling rate of Voice; it offers good sound for music and requires 11K of storage for each second of sound. Stereo Quality is recorded at the same sampling rate as Music Quality, but it uses both channels and therefore takes 22K of memory for each second of recording.

The Video Capture Adapter, which was also built by Tecmar for IBM, captures images at 640 by 480 pixels by 65,536 colors per pixel (16 bits of data per pixel) from a variety of common video sources. To operate the video-capture system, you need both an input video source (e.g., camera, TV signal, or VCR) and a compatible video monitor. This means you will be working with two video screens—your computer monitor and the video monitor. The system works with three types of video inputs and monitors: NTSC, RGB, and Y/C.

The video-capture board is not the only way to get images for use by the AVC. The AVC software provides a crude paint program and a text generator that creates good-looking anti-aliased text. The software also lets you import images from other programs. The import facility supports IMDS (IMage Data Stream format, used by IBM's *ImagEdit*, a gray-scale image-editing program), as well as Targa and TIFF file formats.

To play back presentations, you need the audio board and a VGA- or 8514-compatible monitor; the video-capture board is not used for playback.

The AVC supports three main video modes: MCGA and VGA on VGA adapters, and a special VGA-like 640- by 480-pixel by 256-color resolution on the 8514/A adapter. Although the MCGA mode has a low horizontal and vertical pixel resolution, the increased pixel depth of 256 colors provides fairly realistic-looking, though somewhat jaggy, images.

On standard VGA adapters, the system also supports 640-by-480 horizontal and vertical resolution, but with only 16 colors. Even though the horizontal and vertical pixel resolution is higher in standard VGA mode than in MCGA, the limit of only 16 colors makes color images look much less realistic than MCGA; this is a good example of how pixel depth affects photo-realism more than horizontal and vertical resolution.

However, text and nonphotographic images (e.g., computer-generated graphics) look quite good at this resolution. Also, black-and-white photographic images can be displayed fairly well in this mode by utilizing the available 16 colors as shades of gray for creating gray-scale images.

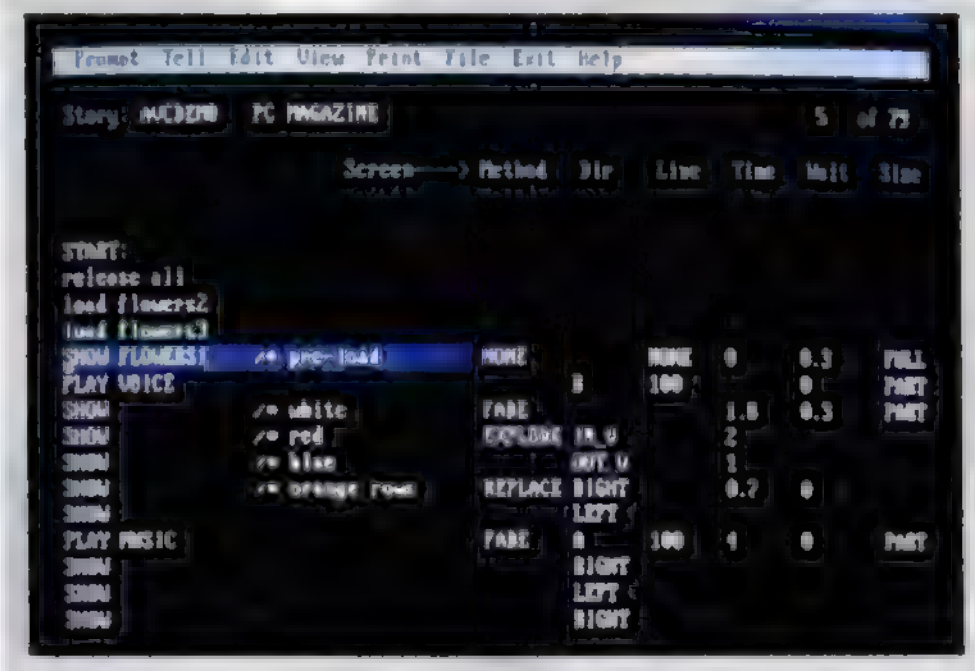
The AVC's best-quality resolution is a VGA-like 640-by-480 mode with the extension to VGA of 256 colors instead of the standard 16 colors. This added pixel depth allows the AVC to produce TV-quality, realistic-looking color images that are quite stunning. The problem is, IBM chose to implement this mode on its expensive 8514/A video adapter because its VGA card supports only 16 colors.

It's unfortunate but worth noting that even though IBM wants you to use an 8514/A video adapter, the AVC does not support the higher-resolution 1,024-by-768 mode of the 8514/A. This makes it seem like IBM must be planning a 256-color extended VGA card.

Another annoying anomaly is that although IBM supplies both DOS and OS/2 versions of a screen-capture utility with the package, the OS/2 version won't work with the 8514/A, requiring you to exit to DOS and use the TSR version of the utility to capture screens. Editing of images is done in 640-by-480-by-256 mode on the 8514/A adapter. Images can then be converted to MCGA and VGA 16-color formats.

As you might expect, a system that produces such eye-popping and ear-filling results is incredibly power hungry. Although its requirements indicate that the AVC product works with DOS and 286-based systems, performance at that level is so bad that only 386-based systems with OS/2 should be considered. Also, the AVC gobbles up disk space like crazy. For presentation systems, be ready to spring for 100MB of hard disk storage (the software itself takes almost 20MB); for authoring systems, 300MB goes fast.

The IBM Audio Visual Connection is an application that begs for optical storage and a 486-based PC. But if you're willing to spend the time and money needed to make this system fly, you'll be in on the ground floor of the future of mainstream personal computing. ■



One of the many editing modes of the AVC software gives you precise control over the mixing and sequencing of sounds and images.

FACT FILE

IBM Audio Visual Connection, Release 1.0
IBM Corp. (Contact your local authorized dealer).
List Price: IBM Audio Visual Connection software, $495; Audio Capture and Playback Adapter (for AT bus), $565; Audio Capture and Playback Adapter/A (for Micro Channel bus), $565; Video Capture Adapter/A (for Micro Channel bus), $2,250.
Requires: 80286-based PC with OS/2 1.1 or later, or 80386-based PC with OS/2 1.1 or later or DOS 4.0 or later (DOS requires expanded memory manager). OS/2-based systems used for authoring presentations: 4MB RAM, 30MB hard disk. DOS-based systems used for authoring: 640K RAM, additional 4MB expanded memory, 30MB hard disk. Systems used for presentations: OS/2 with 3MB RAM and 20MB hard disk, or DOS with 640K RAM, additional 2MB expanded memory, and 20MB hard disk. Also requires VGA- or 8514 A-compatible video adapter and monitor.
In Short: A technological tour de force that combines TV-quality video, high-fidelity stereo sound, database capabilities, and a sophisticated authoring system with its own powerful programming language for creating sophisticated business presentations and interactive multimedia databases. Forget the minimum system requirements; this is one power-hungry system.

CIRCLE 449 ON READER SERVICE CARD

XTreePro Gold: The Champion File Manager Wins New Laurels

HANDS ON
by Edward Mendelson

XTree Pro, the undisputed marathon winner among file managers, has just emerged from two years of training to become *XTreePro Gold*. Like its predecessor, the new version is way ahead of the pack.

XTree Co.'s $129 disk utility has grown into a multitalented package that combines text searches, application launching, file editing, and a few dozen other functions without sacrificing the simplicity of the classic earlier versions.

XTreePro Gold still offers one-keystroke access to basic file-management functions like copying, viewing, printing, and executing files and creating directories. Its Alt- and Ctrl-key menus still give easy access to commands that modify its display or affect groups of tagged files.

But *XTree*'s programmers have incorporated advanced features of DOS shells like *The Norton Commander* and *PC Tools Deluxe*, text managers like *Magellan*, and command-line directory programs like Econo-Soft's *DX*. With *XTreePro Gold*, you can now use the mouse to navigate your disk. You can prune and graft a directory from one branch to another on the directory tree. And you can tag multiple file specifications like *.DOC and LETTER.* across directories and disks; this means that you can use *XTreePro Gold* as a multidisk file finder by logging on to all disks and entering part of the filename you're looking for.

You can also use the package to search for text within files. The search can range across multiple drives and can be limited to a file specification or a group of file specifications in one or more directory or drive. All files that contain the text you want end up tagged in the directory screen, and you can perform any of the program's many functions on them either singly or as a group.

If you use *XTreePro Gold* to back up selected files or whole directories to a floppy disk drive and you run out of disks, you can format a disk without losing track of selected files. You can automatically create a batch file that repeatedly runs the same application, using each file in a set of tagged files as a parameter. And you can edit any file, either with the package's somewhat clunky built-in editor or with an editor you specify in a configuration program.

An autoview function lets you move down a highlighted list of files on the left side of the screen while the right side displays the contents of each file in turn. When you tag a set of files, the file viewer can cycle through them automatically.

The viewer includes search and bookmark functions and allows hands-off scrolling. You can copy selected lines to a separate ASCII file, or when you switch the viewer into hex mode, you can edit the files directly—although a configuration menu lets you turn off the editing option for safety. One minor inconvenience is that you can search only for text, not for hex strings. The viewer automatically translates *Lotus 1-2-3* and *dBASE* files into readable format, and a one-key command makes it present all major word processor files and IBM's DCA/RFT format as recognizable text.

You can split *XTreePro Gold*'s directory screen and view two directories at once, as well as transfer files from one to the other. One feature the program doesn't have is the ability to compare two directories to find matching files. For this, you'll need *PC Magazine*'s DIRMATCH.COM, available on PC MagNet. A phantom compare function appears on the menus illustrated in the *XTreePro Gold* brochure, but that function didn't make it into the program itself.

XTreePro Gold, like *The Norton Commander* and *PC Tools Deluxe*, blurs the distinction between file managers and DOS shells. You can set up a menu that will launch applications and automatically load the program under the highlight while *XTreePro Gold* folds into a mere 7K of RAM. A feature that sounds more confusing than it is lets you set up batch files with names like DOC.BAT or WK1.BAT, move the highlight to a file with the extension .DOC or .WK1, press a key to let the program select a batch file associated with the extension, and use the file under the highlight as a parameter.

When you execute applications from the menus, you can tell *XTree* to remember its directory information, so that it doesn't waste time scanning the disk when it returns after you close the application. You can also store directory information on-disk for instant restarts after you exit the *XTreePro Gold* program entirely.

Still, the *XTree* interface, after years of use, continues to feel quirky. You press Enter to jump from a directory window to a small file window, and then again to jump to a full-screen file window. A third press of Enter gets you back to the directory window. With each press of the Enter key, the menu changes, the Alt and Ctrl keys act differently, and it's easy to get confused over which set of files will appear or be acted upon when you press the Alt or Ctrl key. But the program always warns you before you can do anything destructive, and the menus on rival programs tend to be even more confusing.

XTreePro Gold isn't designed for networks—an older product, *XTree Net*, serves that market at $150 per copy—but for standalone computers. It stands alone as the fastest, most imaginative, and most capable file manager you can find. Just don't forget to supplement it with DIRMATCH. ■

***XTreePro Gold* can display different trees or directories on either side of a split screen.**

FACT FILE

XTreePro Gold
XTree Co., 4330 Santa Fe Rd., San Luis Obispo, CA 93401; (800) 634-5545, (805) 541-0604
List Price: $129
Requires: 256K RAM, DOS 3.1 or later.
In Short: The classic file manager is easier to use and more functional than ever.

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Lotus Add-in Toolkit: A Complete Programming Environment for Release 3

With its *Add-in Toolkit for 1-2-3 Release 3*, Lotus Development Corp. hopes to reach a broader audience than it did with its earlier toolkit for Release 2. Where the Release 2 product provided little more than a set of low-level routines for manipulating spreadsheet objects, the new one offers a complete programming environment centered around a high-level structured language. The Release 2 tools demanded assembler proficiency and some knowledge of *1-2-3* internals; the new set should pose no problems for anyone already steeped in the discipline of structured programming.

The Release 2 tools enabled hundreds of independent software vendors to compete for a piece of the big *1-2-3* aftermarket by writing add-in applications and custom @functions. The new product, which allows the creation of custom macro verbs, as well as @functions and applications, adds users of in-house corporate development tools to that target audience—people for whom the accessibility and maintainability of a high-level language are more essential than zippy performance.

In addition to the language (Lotus Programming Language, or LPL), the new toolkit includes an editor, a compiler, a debugger, and an extensive library of procedures and data structures specifically for *1-2-3*, Release 3. The compiler generates intermediate code that's translated by an LPL interpreter when the add-in is run within *1-2-3*. Procedures written in C or assembler may be invoked as dynamic link libraries, but the first release of the toolkit offers no support to programmers who want to exploit this capability. Lotus promises to remedy this deficiency in the future, but it isn't saying when.

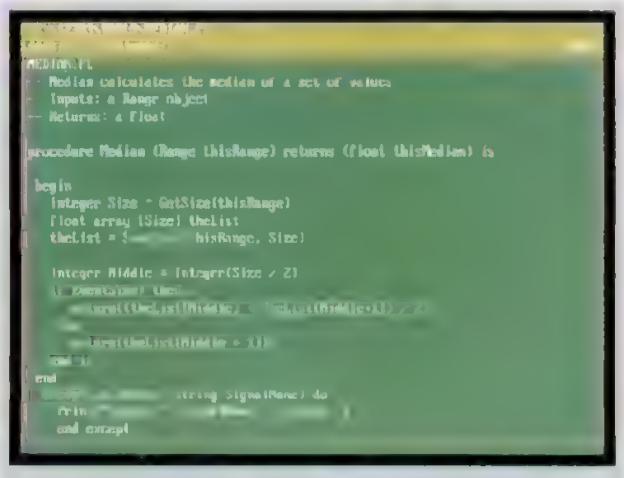
Nothing in LPL itself has anything directly to do with *1-2-3*, but the language allows for user-defined application data types (ADTs), which specify operations for manipulating spreadsheet objects. The core of the toolkit library is a set of ADTs for handling cells, ranges, sheets, files, workspaces, the display, and user input. Documentation and source code are provided for an additional ADT (called Date) to help users learn to create their own.

Since only the library is application-specific, you can expect to see additional LPL libraries in the future that support other Lotus products. In fact, the Release 3 toolkit is just the first element of a grand strategy, originally announced under the name LEAF, for extending and integrating a broad range of Lotus applications.

The other pieces may be a while in coming, but in the meantime, developers have a rich product on which to cut their teeth. The editor is straightforward and flexible. It handles as many files at once as you have memory for, includes two cut-and-paste buffers and a keystroke recorder, and provides an option to verify correct LPL syntax without compiling.

Source code can be compiled from within the editor or from the DOS command line. If you compile from the editor, the compiler returns the cursor to any point in the source code that generates an error.

You can use your own editor in place of Lotus's, of course. And you can also set up Lotus's editor to call your own compiler, in case you want to write in a language other than LPL.



This sample procedure, created with the *Lotus Add-in Toolkit for 1-2-3 Release 3*, finds the median of a range by using Range ADT. Separate procedures in the same module define a bubble sort and register @median as a custom function.

With the debugger, which runs only under OS/2, you can follow source code in one screen session while *1-2-3* and your add-in run in another. The three debugger windows show individual source-code statements, the procedure-call chain, and the status of variables and return parameters for the current procedure. It's hard to imagine doing serious work in LPL without this debugger.

The documentation is copious and clear, and source code for a number of example procedures is provided both on-disk and on paper. The manual takes pains to assist the user who is solidly versed in the *1-2-3* macro language but has never been near a Pascal or C compiler.

Unfortunately, some of the sample code illustrates exactly the current shortcoming of LPL and why it isn't ideal for the average macro jockey. I compiled Lotus's own example for creating a custom @function that returns the median of a range of values. On my 16-MHz 386 machine, the resulting add-in function took 58.5 seconds to analyze 99 numbers. A macro did the same job in a second.

Granted, there are faster sorting methods than the one Lotus happened to use for its example, but the point remains: until Lotus makes it easy to mix C (or assembler) with LPL, there are things that are more efficiently done by *1-2-3* itself (with or without macros) than by an LPL add-in.

Macro mavens who just want to customize Release 3's display and tamper-proof their code should probably wait until Release 3 versions of the popular spreadsheet compilers appear, rather than adopt a whole new language and discipline. The *Lotus Add-in Toolkit for 1-2-3 Release 3* is for those who like the deeper waters and know how to avoid the sharks. ■

FACT FILE

Lotus Add-In Toolkit for 1-2-3 Release 3
Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (617) 577-8500.
List Price: $395.
Requires: *Lotus 1-2-3*, Release 3; hard disk; OS/2 1.1 or later or DOS 3.0 or later; debugger requires OS/2 and 4MB of RAM.
In Short: A complete programming environment consisting of an editor, a compiler, a debugger (for OS/2 only), a structured high-level language (LPL), and an extensive library of functions and data structures tailored for the Release 3 environment. Add-in applications, @functions, and macro verbs are translated by the LPL interpreter at runtime, which can make for unspectacular performance.

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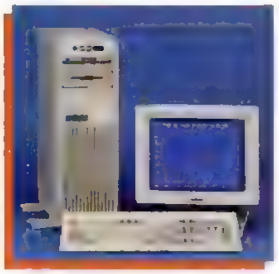

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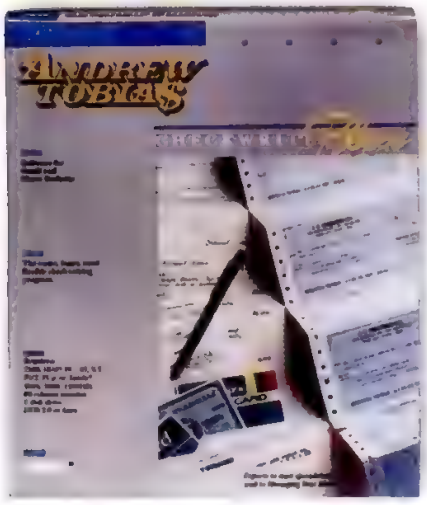

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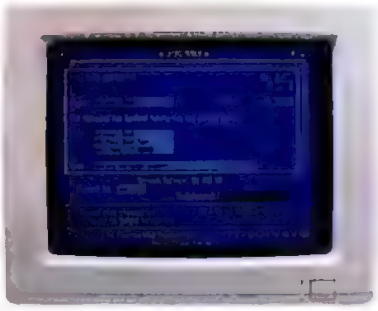

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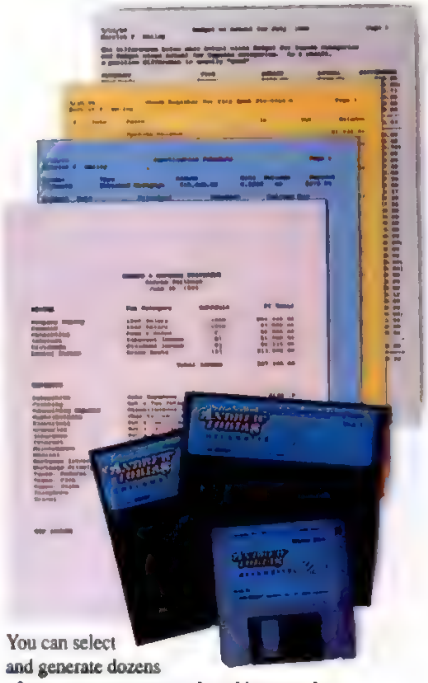

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CIRCLE 214 ON READER SERVICE CARD

VP-Expert/SQL Builds Expert Systems, Leverages Existing Data Files

HANDS ON!
by Richard Hale Shaw

More and more, expert systems are being used as the bases for vertical decision-making applications. Unfortunately, most tools for developing expert systems can't access existing data files without importing them first. Unlike those others, Paperback Software International's *VP-Expert/SQL* lets you build expert systems that leverage existing database or spreadsheet files and also access remote databases on a mainframe or a network.

The expert systems *VP-Expert/SQL* creates are rule-based, consisting almost entirely of English-like rules. The program's inference engine uses both forward- and backward-chaining techniques.

While most expert systems store their rules and facts in proprietary knowledge bases, *VP-Expert/SQL* can read and update *dBASE*, *Lotus 1-2-3*, and *Symphony* files. It not only improves its reasoning with data from these files, but it also can store its findings in them.

VP-Expert/SQL's Induce command can treat a data file as an induction table, in which each row becomes a rule. The last column of each row becomes the goal, and the previous columns become the conditions for deriving the goal. Thus, the inference engine can induce rules from the data file, saving hours of writing complex rules.

When an expert system is running (the process is called a *consultation*), *VP-Expert/SQL* uses text windows to display the interaction between the inference engine and a knowledge base. Two additional windows are available to developers: a Rules window that displays the rules being executed and a Values window that displays the facts being derived.

VP-Expert/SQL's Trace facility tracks the rules executed during a consultation. It creates a trace file that can be displayed in graphical form or as text in *VP-Expert/SQL*'s built-in full-screen editor. On-line help provides information on any *VP-Expert/SQL* command or statement, and the runtime version of the product provides a facility for creating customized on-line help for distribution with an expert system.

VP-Expert/SQL provides graphical images that you can use when building an expert system.

During a consultation, you can use function keys to ask how a value was found or why the system generated a particular question, forcing the inference engine to justify its reasoning. You can also speed up or slow down execution to better observe which rules are being used. And a What If button lets you rerun a consultation with different answers and look for different outcomes.

VP-Expert/SQL's Autoquery command reduces the effort required to build a knowledge base. When Autoquery is on, the inference engine automatically asks the user for any value it can't find in the knowledge base. Thus, the developer quickly determines if a knowledge base needs modification. *VP-Expert/SQL* also lets you assign a confidence factor to each rule, so the engine can further weigh the rules that are true.

Another part of the program has graphical images that an expert system can use to offer a graphical display for mouse support, hypertext, buttons, forms, and gauges. These are available in graphics mode: there is no text-mode hypertext or mouse support like those found in similar programs.

VP-Expert/SQL's most powerful feature is its support for Gupta Technologies' *SQLBase* SQL Server. With *SQLBase* commands, an expert system can manipulate SQL databases, regardless of whether the data is located on a PC, a mainframe, or a network. *SQLBase* masks the location of the files, so if the files are moved, the expert system doesn't have to be changed.

The *SQLBase* commands are simple enough to learn: they're counterparts of the *VP-Expert/SQL* database file commands, prefixed with "SQL". Unfortunately, this means that you'll have to use an additional set of file-handling commands. An SQL window displays these commands as they execute.

The *SQLBase* supplied with *VP-Expert/SQL* is a single-user version that includes a subset of Gupta's *SQLTalk* interactive data-management program. However, you'll have to purchase the full-blown *SQLBase* from Gupta when you are ready to run SQL-based expert systems over a network.

VP-Expert/SQL is an extremely useful, easy-to-learn development tool with tremendous potential, but it doesn't seem complete. I found that three sets of file-handling commands are two too many, and the product's display commands lack integration. Other vendors have developed text-mode technology for dynamic windows, buttons, gauges, and hypertext. Why not have one set of commands that operates in both text and graphics modes? With those touches, the program could become an excellent tool for developing full-blown applications.

As it is, *VP-Expert/SQL* is well documented and perfect for newcomers to expert systems. If you're planning on leveraging an investment in existing data files against an expert system, you should take a close look at *VP-Expert/SQL*. ■

FACT FILE

VP-Expert/SQL
Paperback Software International, 2830 Ninth St., Berkeley, CA 94710-9905; (800) 225-3242.
List Price: *VP-Expert*, $249; with SQL, $695; runtime version, $300 per year (with unlimited distribution).
Requires: *VP-Expert*: 384K RAM, two floppy disk drives, CGA adapter/monitor or above (for graphics), DOS 2.x or later; hard disk recommended. With SQL: 640K RAM, 384K EMS, hard disk, DOS 3.1 or later.
In Short: A powerful, easy-to-use tool for building expert systems, with facilities for accessing existing database and spreadsheet files. SQL component expands access to include mainframe and network SQL databases.

CIRCLE 431 ON READER SERVICE CARD

The Battle of the Low-End Laser Printers Intensifies With New Canon Entry

HANDS ON
by M. David Stone

You say you want a laser printer with high-quality text output, exceptionally good graphics, and scalable fonts? But your budget is just over $1,000, so you're looking for a list price of about $1,500? Until recently, you'd have been out of luck. But now there's the Canon LBP-4, a printer that offers all of these features at a list price of $1,545, just $50 more than Hewlett-Packard's new LaserJet Series IIP.

Built around the same Canon engine used by the LaserJet IIP, the LBP-4 is also identical to that printer in setup, maintenance, and underlying print quality. For features that don't depend on the engine, the LBP-4 is a fraternal twin to the Canon LBP-8 Mark III, with scalable fonts and the superior graphics of the Canon Printer System Language, CaPSL III.

Like other Canon engines, the 4-page-per-minute P110 uses a cartridge that contains toner, drum, and all other consumables. To set up the Canon LBP-4, you insert the cartridge, load some paper, and plug in the printer. Maintenance consists primarily of replacing the cartridge every 3,500 pages or so.

The print quality of the P110 matches that of the Canon SX engine, with notably dark print at the usual 300-dot-per-inch resolution. On the LBP-4, this translates into superb output, with crisp text and truly solid black areas in graphics.

Print speed is also largely a function of the underlying engine. Not surprisingly, the LBP-4 matches the IIP in text speed, clocking in at 3.9 ppm on PC Labs' text speed test. Graphics speed is a little slower than that of the IIP. According to Canon, the speed is affected both by differences in the printers' control languages and by how well the printer driver is optimized for speed.

Regardless of the reasons, the wait is worth it. The graphics output retains far more detail than that of most other printers, as can be seen in the scanned photo sample included with this review. For the LBP-4, the graphics speed was 84 seconds, as opposed to 53 seconds for the LaserJet IIP.

As with the Canon Mark III, the LBP-4 comes with nine scalable fonts plus several bitmapped Courier fonts. The scalable fonts include three typefaces: Dutch (the equivalent of Times Roman), Swiss (the equivalent of Helvetica), and Symbol. Dutch and Swiss come in four versions: medium, medium italic, bold, and bold italic. Symbol matches the PostScript Symbol typeface. The LBP-4's bitmapped Courier fonts include 10-pitch medium, bold, and italic; 15-pitch medium; and 16.66-pitch medium, which is the equivalent of the HP's Line Printer font.

You can print any of the scalable fonts in any size from 1 to 127 points and in any orientation. You also can modify each font with such enhancements as outline, shadow, fill (with a pattern), and shading (with the background shaded). Bitmapped fonts are included in both portrait and landscape orientations.

In addition to its built-in fonts, the Canon LBP-4 has two card slots (the HP LaserJet Series IIP only has one) and uses most of the same cards as the Mark III. These include three bitmapped font cards and one scalable font card. The scalable card adds 22 fonts for $195, giving you nearly all the font choices of a typical PostScript printer (minus Palatino and a scalable Courier) for a list price of $1,740. Canon has also announced an IBM Proprinter emulation card and an Adobe PostScript card.

Some other features that the LBP-4 shares with the IIP include size, weight, and paper handling. The footprint for the 23-pound LBP-4 is a scant 13.8 inches wide by 23.5 inches deep. A built-in stacker tray can hold about 50 sheets of paper and can adjust for any width from 3.62 to 8.5 inches. As with the IIP, most users will probably want to get the optional $195 paper tray with 250-page letter-size cassette. Additional cassettes are available for envelopes and for legal-, A4-, and executive-size paper.

One possible drawback to using the LBP-4 is that CaPSL doesn't have the same wide software support as HP's printer language, HP PCL. According to Canon, CaPSL drivers are currently shipping with such popular programs as *Lotus 1-2-3*, *WordPerfect*, and *Microsoft Word*. For those who already own these programs, Canon will supply a set of drivers. Drivers for *GEM* and *Windows* are being beta tested as of this writing.

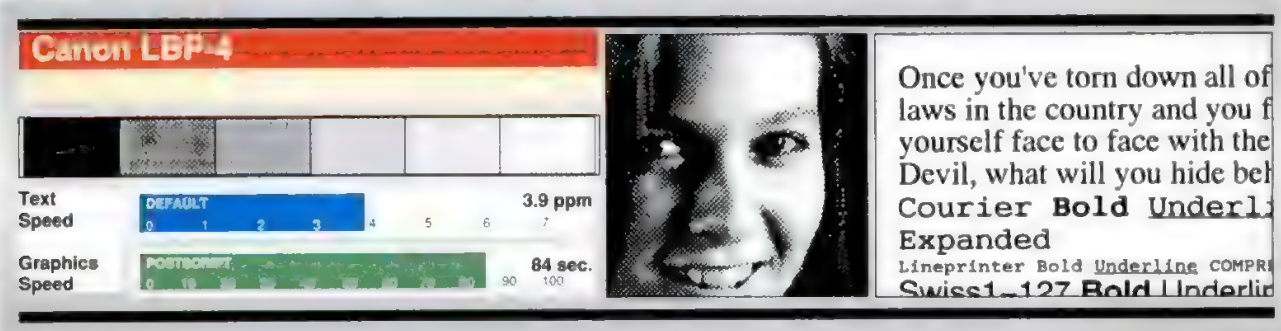
For those programs that don't provide drivers for CaPSL, the LBP-4 will act like a Canon LBP-8II for text and graphics. If all else fails, you can fall back on the built-in Diablo 630 ECS emulation, or you could add one of the plug-in emulation cards.

Until now, there was no better low-end value among laser printers than the HP LaserJet Series IIP. But with the Canon LBP-4 priced at just $50 more than the IIP, there's another show in town. ■

FACT FILE

Canon LBP-4
Canon USA Inc., Printer Division, One Canon Plaza, Lake Success, NY 11042; (516) 488-6700.
List Price: $1,545.
Dimensions (HWD): 7.75 x 13.75 x 23.5 in.
Weight: 23 lbs.
Emulations: CaPSL III, Diablo 630.
In Short: Built around the same 4-page-per-minute Canon engine as the HP LaserJet Series IIP, the LBP-4 offers nine built-in scalable fonts, superb print quality, and an upcoming PostScript compatibility option via a plug-in cartridge. Like earlier Canon printers, the LBP-4 shuns HP compatibility, but support from major software vendors helps make up for that.

CIRCLE 434 ON READER SERVICE CARD



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CIRCLE 163 ON READER SERVICE CARD

Flamingo Editor Brings Strong Drawing and Text-Handling Facilities to Targa Users

HANDS ON
by Alfred Poor

Paint programs are fun to use, but even some of the best fall short of the mark when you need to create professional-quality graphics—especially those incorporating text. But if that's your ultimate mission, Flamingo Graphics' *Logo Editor* may be just the ticket, provided its steep list price ($895 for the Targa version, $1,250 for the Vista version) falls within your budget.

Logo Editor is not for dilettantes. That's evident from its hardware requirements: to use the program, you need an AT-level machine with a Targa or Vista display system, at least 1MB of expanded memory with a full 640K of base memory, and at least 10MB of hard disk space. You also will probably want a fast CPU and a math coprocessor. Even when we ran the program on a 20-MHz 386 without a math coprocessor, it was slow in spots.

Logo Editor **lets you combine graphics, a gradient-tint background, and special text effects all on one screen.**

Logo Editor is anything but slow in its intelligence. It works with graphics as objects—areas are contained by lines that are defined as curves that include certain reference points. The mathematics of splines and enclosed spaces is complex, but this illustration program makes it easy; click the mouse and add a point or drag a curve into a new shape. Still, if you have worked only with bitmapped paint programs, you will probably need to experiment a bit before you learn how to manipulate the points to get the shape you want. Fortunately, the manual that comes with the program includes some simple exercises that help you get started.

Also helpful is the program's interface, which is one of its best features. Menus appear on-screen without your having to touch the keyboard. Move the mouse to the edge of the screen and a different menu will appear, depending on which edge you approach. Within an object, the mouse cursor changes shape at different regions, so that you can reshape, flip, drag, or even delete the whole object, all without having to enter commands at the keyboard.

Logo Editor comes with 10 scalable fonts, and Flamingo Graphics offers three additional sets of about 18 fonts each for $395 per set. At present, the vendor offers only one clip-art package, which contains 26 images, but reports that its developers are working on additional sets.

The effects *Logo Editor* lets you create are excellent. You can quickly produce copies of objects to make shadowed text. Items can be shaded with different degrees of transparency; you can choose colors from five different palette arrangements or blend your own. What's more, you can curve text, rotate it around an object, or shape it to fit an irregular space. All this is easy to learn, too; it took me less than two hours to install the program, run through the tutorial lessons, and create my own image, complete with special text effects.

Graphics can be situated against a solid-colored background or a graduated screen (going left to right, top to bottom, or corner to corner at an angle) for which you specify the start and end colors. You can even import a Targa file and use it as a background for a screen. Although this is a useful feature, on the whole image import is one of the program's weakest points. Unfortunately, *Logo Editor* can only import images as a background; you cannot add them as objects to a *Logo Editor* screen, which means that you must draw any new objects yourself. The program doesn't even offer a line-tracing function.

Since *Logo Editor* is not a paint program, you must create new images as collections of curved objects. Even simple items can require a dozen or more components, so drawing new art can be a time-consuming and labor-intensive process. Until better importing and edge-tracing features are added by Flamingo Graphics, you may want to focus more on text and limit your graphics elements to simple designs. On the bright side, however, you can save your work as a Targa file or export it as an Encapsulated PostScript (.EPS), AutoCAD (.DXF), or Computer Graphics Metafile (.CGM) file. Thus, you can move your work elsewhere if you want to use it with other images.

Also somewhat troublesome is the fact that *Logo Editor* is copy protected. The program uses a hardware copy-protection device that plugs into a parallel port, one of the most unobtrusive methods available. But this technique still leaves the user open to getting locked out of a legitimate copy in the event that there is some malfunction in the copy-protection system. This design also requires that your system have a parallel port.

Logo Editor is more expensive than some of the other illustration programs on the market, but it also has some special capabilities. Competing programs, notably Computer Support Corp.'s *Arts & Letters*, may offer better value for lower-resolution applications, but if you want to create eye-popping images with incredible text effects—and if you've already made an investment in a Targa or Vista board—*Logo Editor* is worth a look. ■

FACT FILE

Logo Editor
Flamingo Graphics, 19 Bishop Allen Dr., Cambridge, MA 02139; (617) 661-1001.
List Price: Targa version, $895, Vista version, $1,250.
Requires: IBM AT or compatible, 640K RAM, 1MB expanded memory, 10MB free hard disk space, Targa or Vista display system or compatible, parallel port (for copy-protection device), DOS 2.0 or later; math coprocessor and at least 10MB storage strongly recommended. Copy protected.
In Short: *Logo Editor* is weak on importing images but lets you create outstanding images from scratch. The hardware requirements are steep, but you are richly rewarded with incredible text effects and excellent object-drawing facilities.

CIRCLE 433 ON READER SERVICE CARD

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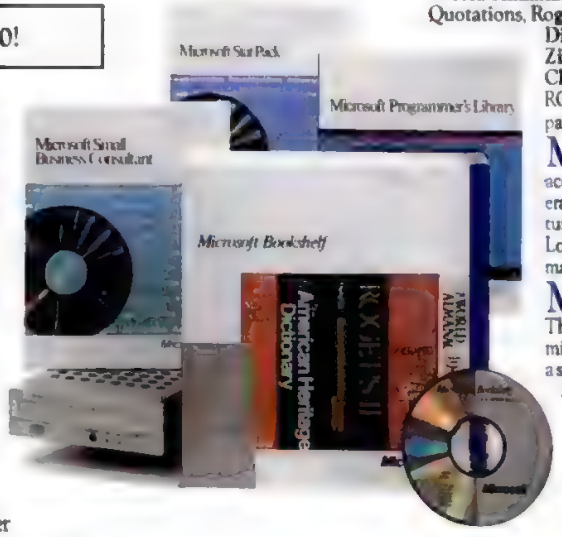

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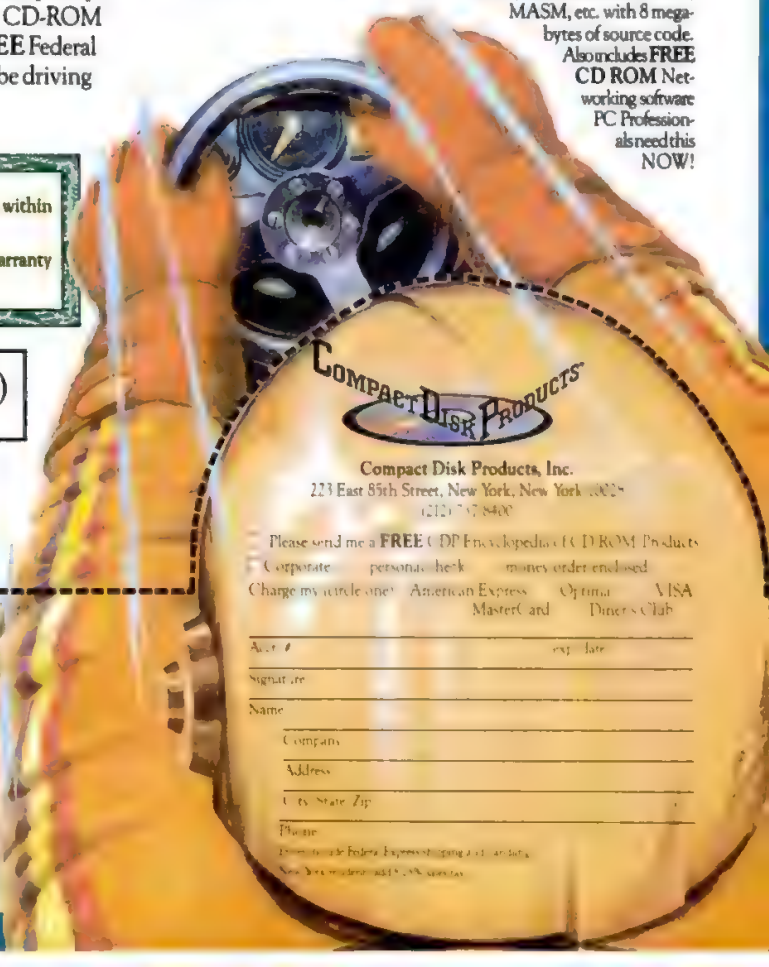
Microsoft Bookshelf (retail $295): An indispensable collection of writer's references for word processor users. This is the most popular CD-ROM title published. You get instant access to: **The World Almanac, Chicago Manual of Style, Bartlett's Familiar Quotations, Roget's II: Electronic Thesaurus, American Heritage Dictionary, Business Information Sources, The U.S. Zip Code Directory, Houghton Mifflin Spell Checker and Usage Alert** and more! All Microsoft CD-ROM's are RAM resident and include powerful cut and paste features for popular word processing packages.

Microsoft Stat Pack (retail $125): Now you have easy access to the abundance of statistics published by the Federal Government—census data, business statistics, agricultural surveys and much more, plus Microsoft Excel and Lotus 1-2-3 spreadsheet files for all tables. A must for marketers and planners.

Microsoft Small Business Consultant (retail $149): The most popular publications of the Small Business Administration and Deloitte, Haskins and Sells on running a small business. Answer tax, accounting, legal, personal, AND financing questions in an instant. A gold mine for businessmen, accountants, and consultants.

Microsoft Programmers Library (retail $395): All the critics are raving *"…a masterpiece of simplicity and function."* **PC World,** May '89. A complete library (over 20,000 pages) of the latest releases of Microsoft's Technical Reference Manuals covering OS/2, Windows MS-DOS, C, MASM, etc. with 8 megabytes of source code. Also includes **FREE CD ROM** Networking software PC Professionals need this NOW!

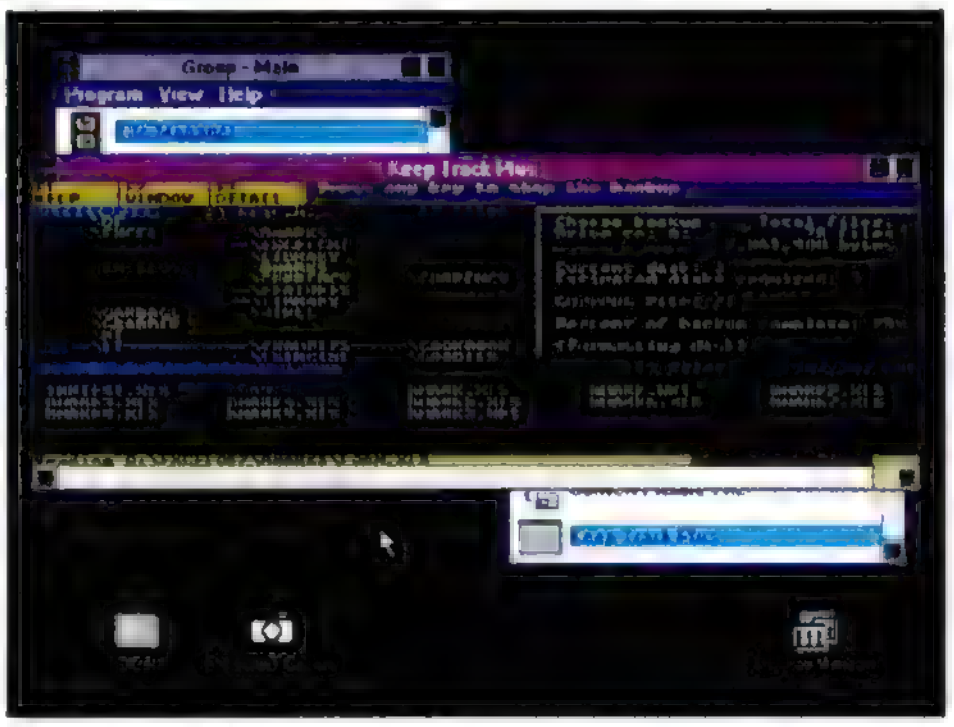


KeepTrack Plus for OS/2 Multitasks System Backups

HANDS ON
by Richard Hale Shaw

Despite the growing number of OS/2 application programs, OS/2 users still largely depend on DOS backup programs. These require that you reboot DOS, since conventional backup utilities need to access system hardware, preventing them from running in OS/2's DOS compatibility environment. But now The Finot Group's $129 *KeepTrack Plus for OS/2* lets users multitask their way through system backups without tying up their systems.

With a few minor exceptions, *KeepTrack Plus for OS/2* resembles its DOS predecessor. You can make full, partial, or selected backups, which *KeepTrack Plus* will store in a file and directory structure identical to that found on your hard disk. Since the program does not use a proprietary format to back up your files, you do not need to use it to restore them; just use the COPY command or work directly from your backup disks. However, *KeepTrack Plus* does offer a restore facility that is as sophisticated as that supplied for backups.



KeepTrack Plus for OS/2 lets you simultaneously back up your files and pursue other activities under OS/2.

KeepTrack Plus provides a visual display of the files and directories on your hard drive. You can select files via a keyboard, type in wildcard masks, or select whole directories. You can also create an exception file to specify files and directories that should be included or excluded from a backup. As you make your selections, *KeepTrack Plus* estimates the number of disks you'll need to back them up. It can also preview the backup so that you can see which files will be included.

While the program offers a plethora of switches for configuring itself to different environments, you may find it annoying to set these on the program command line. A better approach would be to store them in a configuration file that's modified via program switches.

KeepTrack Plus can format disks on the fly by incorporating the formatting process into the backup as it writes the data to the disk. (An option lets you force formatting on every disk.) The program can mark bad sectors, and it can reformat the entire disk or work around the bad spots. While the backup is in progress, *KeepTrack Plus* displays the disk and file number, the total size and number of files backed up, and the percentage of the backup that's been completed.

By taking advantage of OS/2's multitasking capabilities, *KeepTrack Plus* can simultaneously read files from a hard disk while it is writing them to the backup disks. Thus, you can start *KeepTrack Plus*, specify what's to be backed up, and turn to other tasks; *KeepTrack Plus* will notify you when it's time to change floppy disks. The program provides facilities for avoiding conflicts with other OS/2 operations.

While *KeepTrack Plus* is not a Presentation Manager program, it runs fine in a PM window. But its lack of a mouse interface is annoying. The program doesn't yet support the OS/2 1.2 High Performance File System or its 256-character filename schema. However, The Finot Group will supply free updates to a PM version of the program, which will be available later in 1990. In the meantime, *KeepTrack Plus* offers an immediate means for OS/2 users to forget about their DOS-based backup programs. ■

List Price: *KeepTrack Plus for OS/2*, Version 2, $129.
Requires: 384K RAM, one or more floppy disk drives, hard disk, OS/2 1.0 or 1.1. The Finot Group, 2680 Bayshore Pkwy., #101; Mountain View, CA 94043; (800) 748-6480.

CIRCLE 443 ON READER SERVICE CARD

Zipkey Moves ZIP Code Data into Underlying Applications

HANDS ON
by Barry Simon

Zipkey is the kind of application for which computers were made. After you type in a ZIP code, this intelligently organized ZIP code look-up engine responds by providing city and state information to an underlying application.

Remarkably, this shareware program squeezes information on 40,000 ZIP codes into a mere 128K—roughly 3 bytes per entry; *Zipkey*'s look-up engine is a 17K resident program. They can be read from EMS or ordinary memory or from disk.

You can specifically configure *Zipkey* to read the ZIP code from the screen or from a pop-up window into which you've typed your data. You can also configure the program to send a series of keystrokes to your application when you exit *Zipkey*. These can include the city and state information and the ZIP code itself, as well as other keystrokes.

Depending on how you decide to configure *Zipkey*, you can use it to enter an address in a letter or consecutive fields in a database. You can also set up *Zipkey* to support more than one application by using more than one hotkey, more than one exit key, or more than one configuration file.

Updates to the ZIP code database are available from Eric Isaacson Software as frequently as monthly. Since the program is shareware, you can try it before you purchase it. A one-year registration fee for one workstation costs $30.

Anyone who occasionally enters ZIP codes into an application will find *Zipkey* useful. Anyone who regularly deals with city, state, and ZIP code data will find it essential. ■

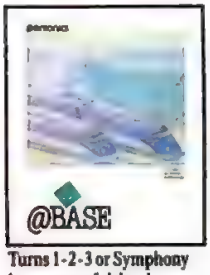
List Price: *Zipkey*, Version 1.0: Shareware (available for one-month trial in Section 8 of PC MagNet's Utilities forum); registration for one year and one workstation, $30 (complex formula for other situations, e.g., $100 for quarterly databases and up to 5 workstations, $300 for monthly updates and up to 24 workstations).
Requires: 256K RAM, DOS 2.*x* or later. Eric Isaacson Software, 416 E. University Ave., Bloomington, IN 47401-4739; (812) 339-1811.

CIRCLE 441 ON READER SERVICE CARD

Build giant multi-sheet applications in 1-2-3.

See more rows and columns with windows and graphs.

Reveal hidden trends and relationships in 1-2-3.



Turns 1-2-3 or Symphony into a powerful database.

Supercharger for EGA and VGA displays.

Like 3M Post-it Notes™ for your PC.

The cure for 1-2-3 Release 3 envy

Look&Link™

1-2-3™ Release 3 delivers impressive 3D features. But many PC users don't have the hardware to run it. And many others are surprised when they discover its trade-offs.*

Let's face it. Lotus has sold us on the *idea* of multi-sheet applications but offers a solution that many 1-2-3 users can't or won't accept. Personics offers a kinder and gentler solution.

LOOK&LINK™ lets you build true multi-sheet applications in 1-2-3 without moving to Release 3. You get dynamic linking and consolidation plus the ability to see two worksheets on screen at the same time. Noted columnist Jim Seymour says, *"LOOK&LINK could be the answer to Lotus users' prayers... It is a lot more important to a lot more users than Allways."*

With LOOK&LINK, any worksheet can pull values out of other worksheets on disk or in expanded memory. (Supported, *but not required!*) There's no limit to the number of linked sheets, and linked values flow in automatically when you load or recalculate. LOOK&LINK even supports automatic chained linking – sheet 1 draws from sheet 2 which draws from sheet 3, etc.

LOOK&LINK's dual sheet display makes setting up links a snap. Just point and shoot. You can also cut and paste between sheets.

For consolidations and roll-ups, LOOK&LINK makes life especially easy. You can sum a stack of sheets in seconds. So join the party. Now any 1-2-3 user can build applications that span across worksheets.

LOOK&LINK 1.1 is an add-in for 1-2-3 Release 2, 2.01 and 2.2. No special hardware or expanded memory is required. Satisfaction guaranteed.

LOOK&LINK adds multi-sheet features to 1-2-3 Rel 2, 2.01 and 2.2

	1-2-3 Release 3	Release 2.2 2.01 & 2.0	Release 2, 2.01 & 2.2 with LOOK&LINK
Link to a single cell	YES	2.2 only	YES
Link to a range	YES	no	YES
Link to a lookup table	YES	no	YES
Linked values in formulas	YES	no	YES
Automatic chained linking	no	no	YES
See two sheets on screen	YES	no	YES
Cut & paste between sheets	YES	no	YES
Point-and-shoot link setup	YES	no	YES
Automatic consolidation	YES	no	YES
Hierarchical consolidation	no	no	YES

*Release 3 is two to three times slower than Release 2.01 in PC Magazine benchmarks. (9/12/89 issue.) It needs lots of memory, lots of hard disk space, and does not support Release 2 add-ins. Expanded memory cards must be re-configured.

"I have a lot of programs on my hard disk, from a lot of vendors – but no other firm is represented by five titles. And no other utility vendor delivers as much value to my kind of computing as Personics."

Jim Seymour
PC Week
January 30, 1989

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CIRCLE 141 ON READER SERVICE CARD

I just bought the Brooklyn Bridge

and now I'm ready to sell it to you!

When I wanted to add a file transfer program to Fifth Generation Systems' line of utility software, I knew it would have to be the best program on the market.

You see, I have a reputation to protect.

My other products (including FastBack Plus and The Logical Connection) have repeatedly won the PC industry's top awards, and are praised by users and editors alike as the best [illegible] of their kind.

That's why I bought The Brooklyn Bridge.

The Brooklyn Bridge does everything that popular file transfer programs do, only faster and easier. But it does so *much more* that it stands all by itself. No wonder PC Magazine named it *Editors' Choice* [illegible] for the second time.

And that's why I'm going to buy The Brooklyn Bridge. Because it's the best and most complete file transfer program there is. Period.

CIRCLE 286 ON READER SERVICE CARD

FIFTH GENERATION SYSTEMS

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For a complete list of features and specifications, or to buy **The Brooklyn Bridge**, visit your leading computer dealer. Or, call 1-800-873-4384 for more information.

Windows Workstation Adds the Network Utilities Windows Lacks

HANDS ON
by Pamela J. Milland and Rock Miller

Face it—*Microsoft Windows* and local area networks don't mix very well. Most network utilities aren't designed to run under *Windows*, and *Windows* itself doesn't include the facilities you need to manage network tasks. But there is a solution: *Windows Workstation* ($1,195), which integrates network print management, security, and messaging right into your *Windows* desktop.

At the time of our review, *Windows Workstation* was available for Novell's *NetWare*, and future releases are planned to bring the same benefits to users of IBM's *PC LAN*, Ungermann-Bass, 3Com's *3+Open LAN Manager*, Microsoft's *OS/2 LAN Manager*, and Banyan Systems' *VINES*.

Installing *Windows Workstation* requires a considerable degree of network knowledge, as well as a supervisor's privileges on the network. If you're not 100 percent sure of network privileges, find someone to do the installation. You should keep ADR's telephone number handy; even though the manual is helpful, it doesn't go into much detail about the pitfalls you might encounter, and it lacks an index, a troubleshooting section, and a description of error messages.

Once you've installed *Windows Workstation*, you are taken directly into the *Windows Workstation Menu* module, which replaces the MS-DOS Executive with a much more attractive and useful shell. *Menu* comes with an excellent menu designer that makes it easy to build beautiful pop-up menus for your applications. But if you already use *Command Post* or some other *Windows* menu system, the *Windows Workstation Extensions*, sold separately, give you the networking functions without the menu builder.

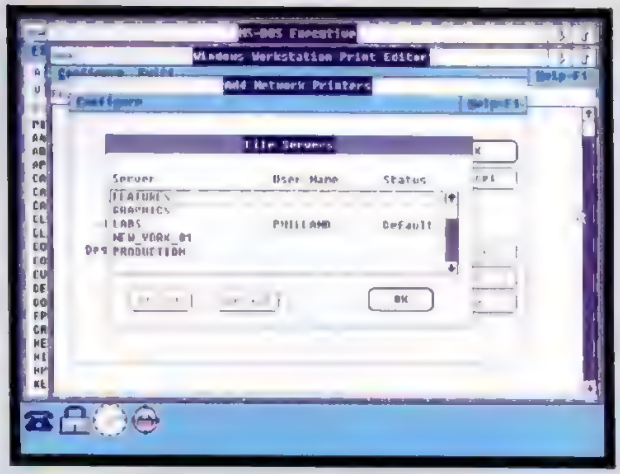
Menu lets you set up group and user menus. Since all the menu data is kept on the file server, you can easily maintain them from any workstation. *Menu* also allows you to designate hotkeys for frequently used applications, and its multiset option lets you quickly launch an entire group of programs with a single command.

Windows Workstation's network-management functions are backed up by a comprehensive security system that includes user passwords, file encryption, and a Secure Station feature that lets you lock up your keyboard and mouse. The Intercom feature lets you broadcast and reply to network messages quickly and easily; if those "Hello from me" messages are annoying, you can turn them off and still remain open to any important bulletins from the network supervisor. In any case, *Windows Workstation* takes its clues from your network seamlessly, so you never need to exit *Windows* or remember obscure commands.

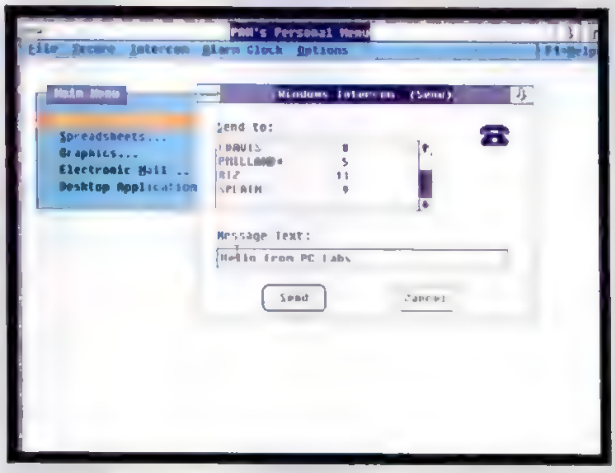
But the star of the show is *Windows Workstation Print Manager*, which really shines at the job of managing your network and local printers. Printers are represented by dazzling icons. Managing your print queues, seeing who and what are printing, and reprioritizing jobs are all a matter of a few mouse clicks. This design makes it easy to hook up to printers on other servers. Therefore, you can send that PostScript file right to the art department's printer simply by clicking on an icon, rather than wading through a string of connection commands.

A screen saver blanks your display when it's not in use, and an alarm clock reminds you of important meetings. The icing on the cake is the context-sensitive hypertext help, the quality of which makes you wonder why Microsoft didn't do *Windows* this way in the first place.

The power of *Windows Workstation*'s modules will make any network manager's light bulb glow. And its impressive design will please *Windows* users looking for an easy way to control their networks. Indeed, whether or not you spend your life in *Windows*, *Windows Workstation* is an excellent way to operate and customize your LAN environment. ■



Windows Workstation Print Manager **provides information about existing file servers.**



Windows Workstation**'s Intercom feature lets you send and receive network messages quickly and easily.**

FACT FILE

Windows Workstation
Automated Design Systems Inc., Windows Resource Center, 375 Northridge Rd., #270, Atlanta, GA 30350; (404) 394-2552.
List Price: *Windows Workstation* (license for single file server, unlimited users), $1,195; modules sold individually: *Windows Workstation Menu*, $695; *Windows Workstation Extensions*, $595; *Windows Workstation Print Manager*, $695.
Requires: *Microsoft Windows* 2.10 or later, *NetWare* 2.1 or later, DOS 3.0 or later.
In Short: This high-quality bundle of network utilities adds the options for network print management, menu creation, and security that *Windows* lacks.

CIRCLE 432 ON READER SERVICE CARD

Northgate Slims Down!

Slimmer. Trimmer. The world's smallest 386, standing not even as tall as America's favorite diet cola. Obviously Northgate has lost a few pounds.

At least in the 386/20 pictured above. But it hasn't lost anything else. How do we pack a 20 MHz real 386 system with a 40 MB hard drive into this space saving, smallest 386 ever introduced?

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Of course we still make the bigger 386. It's up to you.

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by Alan Cohen

New&Improved

News of Announced Products and Upgrades

Pinmap Plots U.S. Geographic Data

NEW

Pinmap, a mapping package from **Hawthorne Software Co.**, gives marketing professionals—and anyone else who works with geographic statistics—a painless way to superimpose plots of numerical data on colorful maps of the U.S.

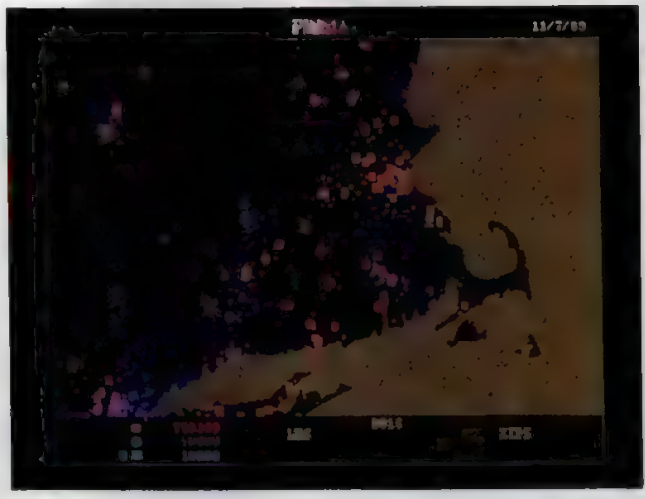
Data can be imported from a spreadsheet, database, or word processor and mapped in one of six different ways: by state, county, or city (the package recognizes 861 key cities); by five-digit ZIP code; by the first three digits of a ZIP code; or by creating a unique area. Red, green, and blue "pins" represent high, middle, and low values of data points; the pins are available as dots, triangles, and squares. The user can customize the maps and how the pins are used.

Pinmap allows a user to zoom in on any area of a map, or to point to a specific pin and display that pin's data value and geographic identification.

Dr. Halo III, from Media Cybernetics, is included in the package and allows users to customize and enhance the maps. Maps can also be saved for future use or printed out on a wide variety of output devices.

List Price: *Pinmap*, $750 ($675 until March 1990). **Requires:** IBM PC-XT, PC AT, PS/2, or compatible; 640KŒ20RAM; hard disk with at least 5MB free space; EGA or VGA graphics adapter; DOS 3.2 or later. Mouse recommended. Hawthorne Software Co. Inc., P.O. Box 35, Hawthorne, NJ 07507; (201) 304-0014.

CIRCLE 438 ON READER SERVICE CARD



Users can zoom in on any part of a *Pinmap*-created display.

HOT PROSPECT

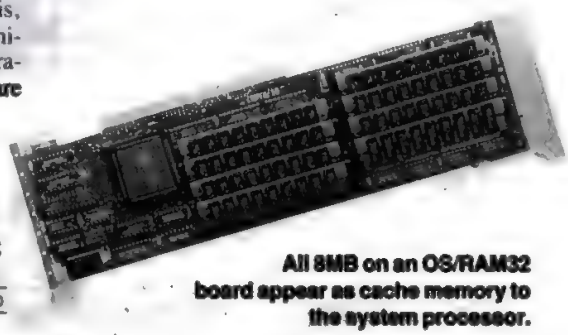
OS/RAM32 OPERATES AS BOTH 16- AND 32-BIT MEMORY BOARD IN PS/2s

OS/RAM32, from **Capital Equipment Corp.**, is a new memory board capable of working with both 16- and 32-bit Micro Channel computers. It features a single-chip interface that allows it to operate at the highest data rate supported by a specific MCA machine.

The card, which can accommodate up to 8MB worth of 256-kilobit or 1-megabit 80-nanosecond SIMMs, automatically configures itself for DOS, OS/2, or Unix without the use of device drivers. The IBM BIOS recognizes the CEC ROM included with the board and transfers control to it during the boot-up process. This, according to the company, eliminates the need for user configuration when operating systems are changed.

List Price: OS/RAM32 with 0K, $299; 80-nanosecond SIMMs, $159 per megabyte. Capital Equipment Corp., 99 S. Bedford St., #107, Burlington, MA 01803; (800) 234-4232, (617) 273-1818.

CIRCLE 435 ON READER SERVICE CARD



All 8MB on an OS/RAM32 board appear as cache memory to the system processor.

JetFax/PC Enables JetFax, Omnifax PPI Users to Send Faxes

NEW

In its basic configuration, JetFax, a plain-paper interface module from **Hybrid Fax**, receives facsimile transmissions and prints them out on an HP LaserJet Series II printer. Now, thanks to Hybrid's new software add-on, *JetFax/PC*, the JetFax unit can *send* faxes, as well.

JetFax/PC can transmit files in ASCII, TIFF, and .PCX formats and supports mixed file types on a single fax page. The program can be used by a single person or by an entire workgroup sharing one JetFax-equipped LaserJet; this eliminates the need for a separate phone line at every PC on a network.

Furthermore, because Hybrid has eliminated the requirement for an internal fax board, *JetFax/PC* users need not worry about the installation and compatibility problems common to those cards.

The package works by allowing users to send a PC file to the JetFax as though it were an ordinary print file. Once marked for transmission, files may be sent immediately or at a specified time to single or multiple locations. Because it functions externally to the PC, the JetFax unit performs all dialing and transmission operations without affecting the computer's performance.

CONTINUES ON PAGE 54

New & Improved

JetFax/PC

CONTINUED FROM PAGE 53

Current JetFax owners can receive a free firmware upgrade for their units; the upgrade will allow for the installation and operation of the *JetFax/PC* program. JetFax units now being manufactured can immediately accept the software.

JetFax/PC also works with the Omnifax PPI, a model of the JetFax manufactured by Hybrid and marketed by **Telautograph Corp.**

List Price: *JetFax/PC*, $195; site license for unlimited users sharing a single JetFax, $395.
Requires: JetFax, 512K RAM (70K if resident), HP LaserJet Series II or compatible, DOS 2.0 or later. Hybrid Fax Inc., 1733 Woodside Rd., #335, Redwood City, CA 94061; (415) 369-0600.

CIRCLE 439 ON READER SERVICE CARD

SmartCache Module Mirrors Hard Disk Through Hardware

NEW

Mirroring—simultaneously writing data to two disk drives—ensures that vital information will be available should one of the drives suddenly fail. It is a procedure that, until now, has been achieved primarily through software.

SmartCache Mirroring, from **Distributed Processing Technology,** tries a new tactic: it mirrors through hardware. A plug-in module for the company's line of disk controllers, SmartCache Mirroring off-loads all mirroring overhead from the host CPU to the 68000 processor on-board the SmartCache controller. This, according to DPT, results in uninterrupted system performance.

SmartCache Mirroring works with ESDI, ST-506, and RLL disk drives and features a .5-millisecond cache access time (cache is expandable to 16MB). An audible alarm is provided to inform the user of a catastrophic disk

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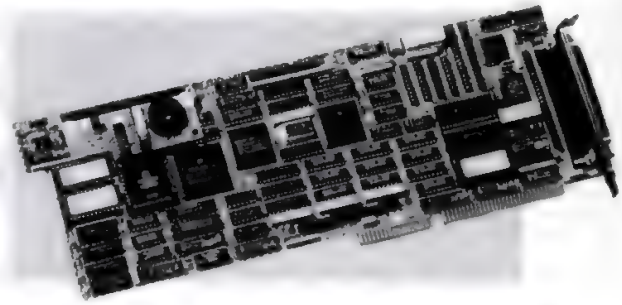
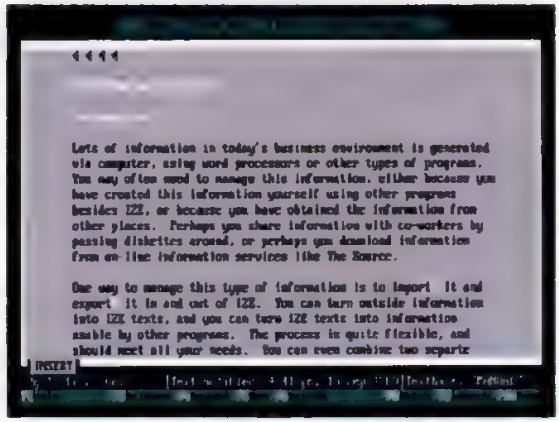


DPT's new mirroring module plugs into any of the company's SmartCache disk controllers.

IMPROVED

***IZE*, Version 2.0**—The upgraded release of Persoft's personal information manager features an improved user interface, as well as enhanced search and import capabilities. *IZE*, Version 2.0, allows users to load a specific textbase from the command line and displays the name of the textbase on the status line. Wildcard full-text and keyword searches are provided, as are fuzzy searches, and textbases can be designated read-only to protect stored data. A password option provides added security. *IZE*, Version 2.0, retails for $495. Current registered owners can receive the upgrade to the new release for $75. Also available is a network server edition, Version 2.0S, which costs $1,495 for the first five nodes and $995 for each additional set of five nodes. *IZE Reader*, a scaled-down version of *IZE*, maintains all of the full product's retrieval and organizational abilities and is available for $99. Persoft Inc., Madison, Wis.; (800) 368-5283, (608) 273-6000.

***Working Hours*, Version 2.0**—The second version of Power Up Software Corp.'s employee scheduler package, *Working Hours*, can report the numbers of employees and hours scheduled per day or week, or the numbers of employees and hours allotted to any one task. The program also schedules employees around the clock and accounts for coverage needed during lunch and other break periods. The package automatically flags scheduling conflicts and maintains a full employee database. Six weekly scheduling formats are provided, and the user has the option to break weekly schedules down into hours, shifts, days, or tasks. *Working Hours*, Version 2.0, is available for $99.95. Registered owners of Version 1.0 can upgrade to the new release for $20. Power Up Software Corp., San Mateo, Calif.; (415) 345-5900.



The improved user interface in *IZE*, Version 2.0, displays the name of the textbase on the status line.

***Data Junction*, Version 3.01**—*Data Junction*, the data-conversion package from Tools & Techniques, is now available in three enhanced versions. *Data Junction: Standard, Data Junction: Professional,* and *Data Junction: Advanced* all feature an improved user interface, an expanded EZ-Convert mode, speed improvements, and new conversion filters. *Standard* supports conversions to and from *dBASE II, III,* and *IV, Lotus 1-2-3, Symphony, askSam,* ASCII, .DIF, and *Enable* formats, as well as *WordPerfect, WordStar,* and *Microsoft Word* mail-merge files. *Professional* adds binary, EBCDIC, *Paradox, R:BASE, Microsoft Excel, SuperCalc,* SYLK, *Clarion,* and *Btrieve* support. *Advanced* can translate all of the above formats, as well as *Informix, XDB,* and *Oracle* files. *Data Junction: Standard* is available for $99, *Data Junction: Professional* for $199, and *Data Junction: Advanced* for $299. Current owners of *Data Junction,* Version 2.0 or 2.1, can upgrade to *Professional* for $69 or to *Advanced* for $169. Tools & Techniques Inc., Austin, Tex.; (800) 444-1945, (512) 482-0824.

Sytos Plus—An upgraded version of Sytron Corp.'s *Sy-Tos* file-backup and -restore utility for standalone and networked PCs, *Sytos Plus* runs on multiple operating-system platforms and features a new graphical user interface. The package supports DOS, Unix, and the OS/2 Presentation Manager, and it offers users the ability to back up files to a wide range of media, such as floppy disks, tape, DAT, and optical disks. According to the company, *Sytos Plus* operates at speeds of up to 20MB per minute. The package also features data-compression capabilities and Error Correction Code data protection to enable recovery of damaged

CONTINUES ON PAGE 56

BORLAND'S NEW SPREADSHEET

THE BALANCE OF POWER: QUATTRO® PRO

	QUATTRO PRO*	Lotus 1-2-3* v 2.2	Lotus 1-2-3* v 3.0
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3-D Graphs	✓		
Built-in draw package	✓		
Individual cell font control	✓	✓	
Shading and borders	✓	✓	
Print graphs & spreadsheets side-by-side	✓	✓	
CONSOLIDATION			
Multiple spreadsheet windows	✓		✓
Multipage consolidation	✓		✓
Keyboard and mouse support	✓		
Lotus 1-2-3 v 2.01 compatibility	✓	✓	✓
Spreadsheet Capacity (NSTL)** 640K RAM	11	8	NA
Spreadsheet Capacity (NSTL)** 1Mb RAM	18	12	5
Price***	$495	$495	$495

*Clip art from PicturePaks™ by Marketing Graphics Inc. (MGI) **NSTL (National Software Testing Labs) measured spreadsheet capacity by counting how many years of data could be added to a spreadsheet. Large numbers mean greater capacity. Performance for v 2.2 is with Allways attached. ***Based on suggested retail prices as of October, 1989.

"QUATTRO PRO seems to do the impossible: It maintains compatibility with 1-2-3; adds functionality that no version of 1-2-3 has and still runs large spreadsheets in 640K."

PC WEEK, *September 4, 1989*

"Borland squeezes such features as multipage consolidation, advanced linking, and live graphics into a package that runs on 512K systems with its Virtual Real-Time Object-Oriented Memory Manager (VROOMM™) technology."

InfoWorld, *September 4, 1989*

QUATTRO PRO, with a unique balance of power, does *both* advanced publishing *and* multipage consolidation.

Lotus 1-2-3's Release 2.2 cannot do both. Neither can their Release 3.0 (see comparison chart).

QUATTRO PRO is compatible with 1-2-3.® It comes with a built-in draw package, clip art library,* and Bitstream® typefaces for presentation-quality output.

QUATTRO PRO does it all today.
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BORLAND

CODE: MQ24

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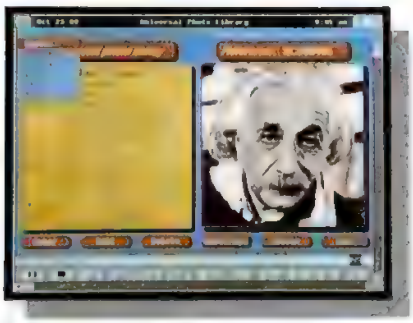
CIRCLE 377 ON READER SERVICE CARD

Pure GUInius



Design forms to integrate directly with the database. Build them into menu or push button driven solutions.

The benefits of graphical user interfaces (GUIs) are dramatic. Consistency. Ease of learning. Presentation quality output.

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New & Improved

SmartCache

CONTINUED FROM PAGE 54

failure on any one of the drives.

Compatible with all 286 and 386 standard-bus PCs, SmartCache Mirroring requires no software drivers; it thus can be used with any operating system or application.

List Price: SmartCache Mirroring Upgrade Kit (includes plug-in module for existing SmartCache controllers), $800; SmartCache Mirroring Complete Kit (includes SmartCache controller, SmartCache Mirroring module, and DPT utility software), $1,950. Distributed Processing Technology, 132 Candace Dr., P.O. Box 1864, Maitland, FL 32751; (407) 830-5522.

CIRCLE 437 ON READER SERVICE CARD

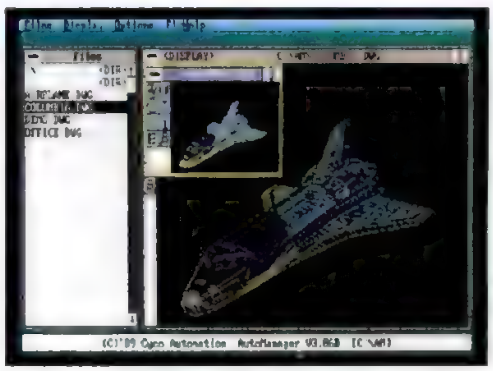
IMPROVED

CONTINUED FROM PAGE 54

data blocks. Data encryption and password protection are provided to ensure security on the backup media. *Sytos Plus* retails for $189.95. Registered owners of *Sy-Tos* can receive the upgrade to the new release for $69.95. Sytron Corp., Westboro, Mass.; (508) 898-0100.

Peachtree Complete III—*Peachtree Complete III,* an updated release of Peachtree Software's accounting package, features a new Purchase Order module. It also offers enhanced versions of several other modules, including Inventory, General Ledger, Accounts Payable, and Accounts Receivable. The new Inventory supports five costing methods—LIFO, FIFO, Specific Unit, Standard Cost, and Average Cost—and stores products and services in the same file. The nine modules that make up the new package (the other modules are Invoicing, Payroll, Job Cost, and Fixed Assets) can be integrated on a single PC or distributed among separate computers. *Peachtree Complete III* also features pop-up menus, automatic file backup, scrolling reference tables, on-the-fly addition of vendors and general ledger accounts, shortcut keys, a streamlined installation procedure, and rewritten documentation. The package retails for $199. All current users of *Peachtree Complete II* can obtain the upgrade for $99. Copies of *Peachtree Complete II* purchased since September 1, 1989, can be upgraded to the new release for $24.95 (plus shipping and handling). Peachtree Software, Norcross, Ga.; (404) 564-5700.

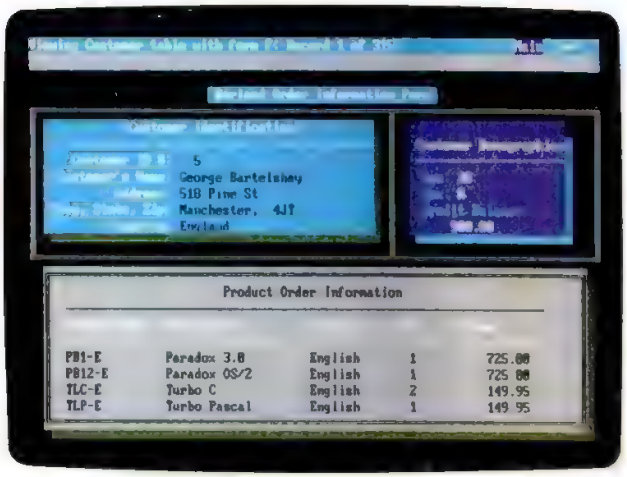
***AutoManager,* Version 3.0**—Cyco International's *AutoCAD* drawing-management utility, *AutoManager,* now works with *AutoCAD* under both DOS and OS/2. It allows users to select a drawing file and then simultaneously load that file and enter the *AutoCAD* program. Version 3.0 also features mouse support and multiple windows (the number is memory dependent) to access and manipulate drawings. Users can zoom and pan through images and toggle drawing layers on and off. The new version also allows users to reference and access the *AutoCAD* blocks in a drawing. *AutoManager,* Version 3.0, retails for $299. Current owners who purchased *AutoManager* prior to May 15, 1989, can receive the upgrade for $100. Owners who purchased their package after that date can upgrade for $50. Cyco International Inc., Atlanta, Ga.; (404) 634-3302.



***AutoManager,* Version 3.0, supports multiple on-screen windows for easier editing of drawings.**

***QICstream,* Version 2.0**—*QICstream,* Version 2.0, is an enhanced version of Archive Corp.'s networking software for the ArchiveVP series of tape backup systems. Version 2.0 supports the AppleTalk File Protocol in *NetWare,* Version 2.15, and this feature, combined with the package's Universal Tape Format capability, allows users to access a Novell file server and to back up and restore both DOS and Macintosh files on the same tape cartridge. Additional features of the new package include an event logger for unattended backup operation, wildcard capabilities for file selection, and automatic retry of busy files on a network. *QICstream,* Version 2.0, retails for $200. Current registered owners can receive the upgrade to the new release for $25. Archive Corp., Costa Mesa, Calif.; (800) 237-4929.

Power without pain.



Multitable form dynamically displaying information from three related tables.

You don't have to be a programmer to have easy access to our highly sophisticated, powerful relational database, Paradox® 3.0.

Paradox 3.0 is all-powerful and never painful because *it* makes all the complex inside moves, you don't. While it does the complex for you, the complexity is hidden beneath clear, natural, even intuitive pathways and patterns that make life easy for you.

With Paradox 3.0, there are no Unclears, no Unknowns. You don't need an army of in-house technical support people. And best of all, you *don't have to be a programmer* to be a pro with Paradox. It's all gain, no pain.

"Query-by-Example" for example

Use this checkmark and you're using QBE. It's that easy. Let's say you need to know in a hurry which of your Los Angeles customers bought more than 5 pairs of white shoes. First ✓ the customer field, then type "LA," "white," and ">5," and you're done. Paradox gives you the right answer, right now. And how much programming to do all that ? Zero.

If your database experience so far is limited to the flat-file type rather than relational, or even if a spreadsheet is the only program you've used before, Paradox gets you up and running immediately with just a ✓.

Record-locking and Auto-Refresh make the network safely network

Paradox has become the leading networker because it handles multiple users intelligently. If someone in your group or network has accessed a record, automatic record-locking keeps everyone else from changing it.

That way, two or more people can't change the same data at the same time. (As a bonus, Paradox also tells you *who* is using a record at a particular instant.)

Once the record has been changed by someone in the network, *Auto-Refresh* kicks in *automatically* and updates everything. Everyone in the network is looking at up-to-the-minute information.

Paradox, for the looks of things

Presentation-quality graphics are another Paradox distinction. They give you and your work the professional look.

Paradox instantly turns your tables into graphs with *one* keystroke—and in multiuser environments, with a few keystrokes your graph can show up-to-the-minute changes. Not only does everyone get the picture, they get an accurate picture.

The Real Winner

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DBMS READERS' CHOICE — NOVEMBER 1989

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Code: MX08

BORLAND

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PostScript Power For Your LaserJet. Only $195.

Without PostScript capabilities, the HP LaserJet™ is a magnificent, underutilized machine. In most offices it chugs. Now, in every office, it can fly.

With PreScript™, the exciting, new software package from POC, you can turn your LaserJet into a PostScript printer—without the high cost, the inconvenience, or the speed degradation of other upgrade solutions.

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Only PreScript gives you *online printing*, letting you print without exiting your application. Only PreScript gives you WYSIWYG *preview* capability, so you can see your document on the screen exactly as it will print. Only PreScript gives you full page graphics without a printer memory requirement.

And PreScript runs up to five times *faster* than other solutions, particularly for graphics intensive pages and pages that switch fonts frequently. For even faster printing, an optional PreScript interface card is available for use with the LaserJet Series II.

Plus, you get unlimited scalable, rotatable fonts along with all of the PostScript special effects, including support for powerful grey scale generation, character path, complex clipping, arbitrary image scaling and rotation, and curve drawing with flatness control.

PreScript requires no expensive printer controller. No extra printer memory. No external drivers. No soft fonts or font cartridges. No hidden costs.

So make your LaserJet take off for pennies. Power up with PreScript: 13 fonts ($195); 35 fonts ($395); optional interface card ($295).

System requirements: 286 or 386 PC with 2 MB of extended memory; DOS 3.1 or higher; PreScript also works with the HP DeskJet and other HP-PCL compatible printers.

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Extra-High-Density Drives Squeeze 2.8MB On 3.5-inch Disks

NEW

MicroSolutions and **Practical Computer Technologies** give new meaning to the term *mass storage*—each company has introduced an extra-high-density disk drive capable of storing 2.8MB of data on a 3.5-inch disk.

The MicroSolutions product, the $449 external Megamate 2.8, features a 1-MHz data-transfer rate, plug-in installation, and full read/write compatibility with all 3.5-inch formats (though you'll need a 2.8MB diskette to take full advantage of the unit's extra storage capabilities).

Practical Computer Technologies' $399 Practidisk EXD drive also attaches externally and features a 1MB-per-second data-transfer rate. The Practidisk is downwardly compatible with high- and double-density diskettes; it too requires higher-density disks to take advantage of the higher capacity.

List Price: Megamate 2.8, $449. MicroSolutions, 132 W. Lincoln Hwy., Dekalb, IL 60115; (815) 756-3411. Practidisk EXD, $399. Practical Computer Technologies Inc., 3972 Walnut St., Fairfax, VA 22030; (703) 385-3332.

CIRCLE 440 ON READER SERVICE CARD

Data Resources Available On-line

NEW

Computer Directory, the newest component of **Ziff Communications Co.**'s Computer Library on-line information service, provides CompuServe and PC MagNet users with the latest data on over 55,000 hardware and software products sold in the U.S. The directory, which is updated monthly, also offers profiles of 9,500 manufacturers.

A menu-based search routine allows users to pinpoint the exact product, or group of products, they wish to learn more about. Information can be retrieved according to a variety of criteria, including product name, product type, and price range.

CompuServe and PC MagNet users can access Computer Directory by entering the command GO COMPLIB.

List Price: Contact Computer Library for price details (there are additional surcharges for this service). Computer Library, Ziff Communications Co., One Park Ave., 5th floor, New York, NY 10016; (212) 503-4400.

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Every 500 years or so, comes

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A printer that can raise your productivity as much as the new IBM LaserPrinter doesn't come along every day.

Not only does its advanced design make it outperform the HP LaserJet Series II, which up till now has been the benchmark in laser printing. But also, its advanced design gives the IBM LaserPrinter a dramatically new, more space-efficient shape.

Yet with all this, there's one area in which the competition rises above us: their price.

We just advanced the art of laser printing a full 25%. The new IBM LaserPrinter gives you state-of-the-art print quality a full 25% faster than its main competitor.

Why other printers can't follow in our footsteps. The advanced design and engineering of the IBM LaserPrinter give it a footprint that's 33% smaller than its main competitor's. And that 33% gives you more usable workspace.

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an exceptional printer along.

The new IBM LaserPrinter, 1989.

		IBM LaserPrinter	HP LaserJet Series II
Speed	✓	up to 10 ppm	up to 8 ppm
Footprint	✓	291 sq. in.	432 sq. in.
Paper-handling options	✓	500 sheets, 75 envelopes	15 envelopes*
Collates letters/envelopes	✓	yes**	no
Plotter emulation	✓	standard	optional
Resident fonts	✓	10	6
Font card size***	✓	credit card	"8-track" cassette
Standard weight	✓	33 lbs.	50 lbs.
Parts***	✓	400	1000
Dots per inch		300 x 300	300 x 300
Printer emulation	✓	IBM, HP compatible	HP compatible
Printer engine		IBM	Canon
List price	✓	$2,595	$2,695

*HP envelope tray replaces standard paper tray **With paper-handling options ***Approximate

It also takes the lead in paper-handling options by offering automatic collating of letterheads, second sheets and envelopes.** Plus more ample storage capacity.

See history in the making by having your IBM Authorized Dealer or IBM marketing representative demonstrate the exceptional new IBM LaserPrinter. Locate your nearest dealer by calling 1 800 IBM-2468, ext. 194.

The new IBM LaserPrinter. Suddenly, nothing else measures up.

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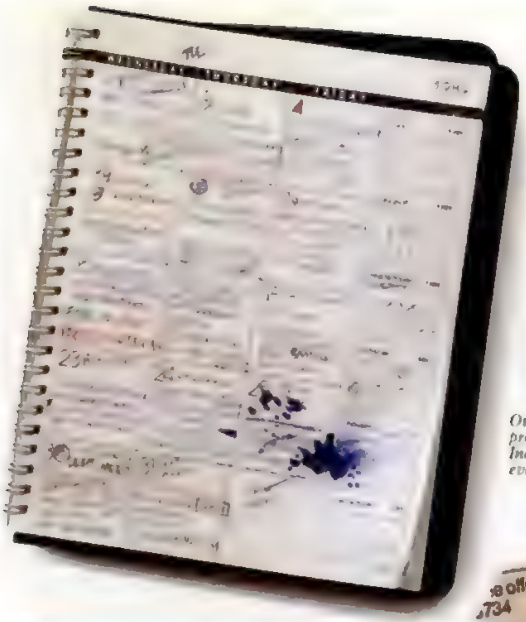


Our PC CACHE can accelerate disk intensive applications dramatically.

Encrypt financial info, employee data, contracts and other sensitive information in a format nobody can crack. Except you

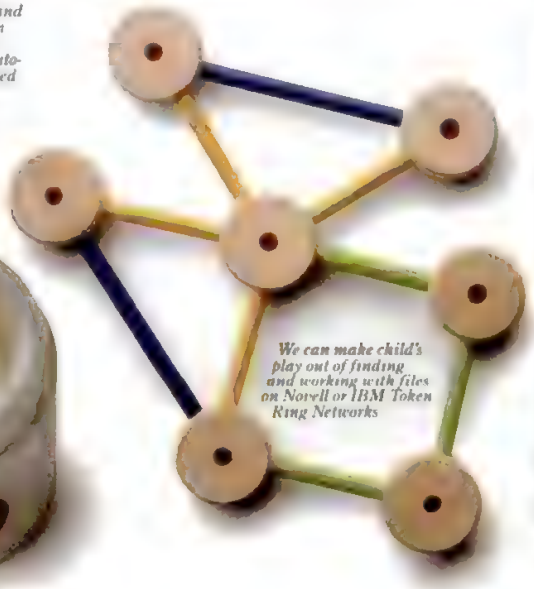
Our desktop manager is one of our most noteworthy features. It has a word processor, database, autodialer, telecommunications and much more. Including a calendar to help you keep appointments, print out to-do lists, even graph your free time.

In the event your disk goes up in smoke, PC BACKUP makes sure you won't get burned. It's breathtakingly fast, reliable and extremely easy to use.

Find files and preview them in their native formats (includes support for top application software), in a fraction of the time it formerly took. Hit LAUNCH and your application and associated data file are automatically loaded.

Inadvertently losing a file is easy to do. Our UNDELETE makes it just as easy to undo. (Recovers entire subdirectories too.)

Our clipboard lets you cut information from your spreadsheet and paste it into your word processor (or any other application) without re-entering data or text.



We can make child's play out of finding and working with files on Novell or IBM Token Ring Networks.

A new vision of utilities.

Central Point Software's vision is that a utility product should enhance your productivity every moment you're at the keyboard. Not just simply recover a deleted file or backup your hard disk like the others.

That's why we developed PC Tools Deluxe, a whole new approach to what a utility product should be. It not only protects you from misfortune by providing you the most common "standard" utility functions available, but it also includes features to simplify everyday tasks. Like allow you to find, preview and load a 1-2-3 spreadsheet. Make it easy to combine the contents of one document into another. Even allow you to look up a client's address while you're in the middle of another application.

But it's not just what PC Tools Deluxe does that makes it different. Its windowed environment (which is SAA compliant) makes doing all these things incredibly easy. And it's consistent, so once you learn one capability, you learn them all.

PC Tools Deluxe. It will make everyday life a little simpler, and allow you to breathe a little easier when you need to recover a file or restore your hard disk.

PC Tools Deluxe 5.5

Central Point Software Inc.

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Users of versions prior to 5.5, call (503) 690-8090 for upgrade details.

CIRCLE 749 ON READER SERVICE CARD

by Gus Venditto

Pipeline

A Look at the Trends Shaping the Personal Computer Market

Expert Advice Becomes Competitive Advantage in Tax Software This Season

Tax season is still a few months away, but tax-software publishers are already jockeying for position.

One of the old-timers in the game, *PC/TaxCut*, has been through two major transitions in little more than a year, and it is about to become the most interesting program in the tax-preparation-software bunch.

MECA Ventures, which codevelops financial software with best-selling author Andrew Tobias (*Andrew Tobias' Managing Your Money, Andrew Tobias' Checkwrite Plus*, and others), bought into the game last year by acquiring *PC/TaxCut* from Best Programs. A few years earlier, *PC/TaxCut* was one of the leaders—but that was before *TurboTax* rose from ground zero to market dominance in less than two years.

TurboTax, from ChipSoft, brought modern software design to Form 1040 and the other federal papers by using a simple interface and a screen that resembles the forms you wrestle with.

Until then, each tax program had had a unique design that wasn't even vaguely reminiscent of the federal forms, divorcing the user from the job of completing the tax forms and needlessly complicating the entire process. *TurboTax*'s overnight success was rivaled only by that of *MacInTax*, which offered the same approach to Mac users.

In recent years, leadership in PC tax software has come to represent sales of over

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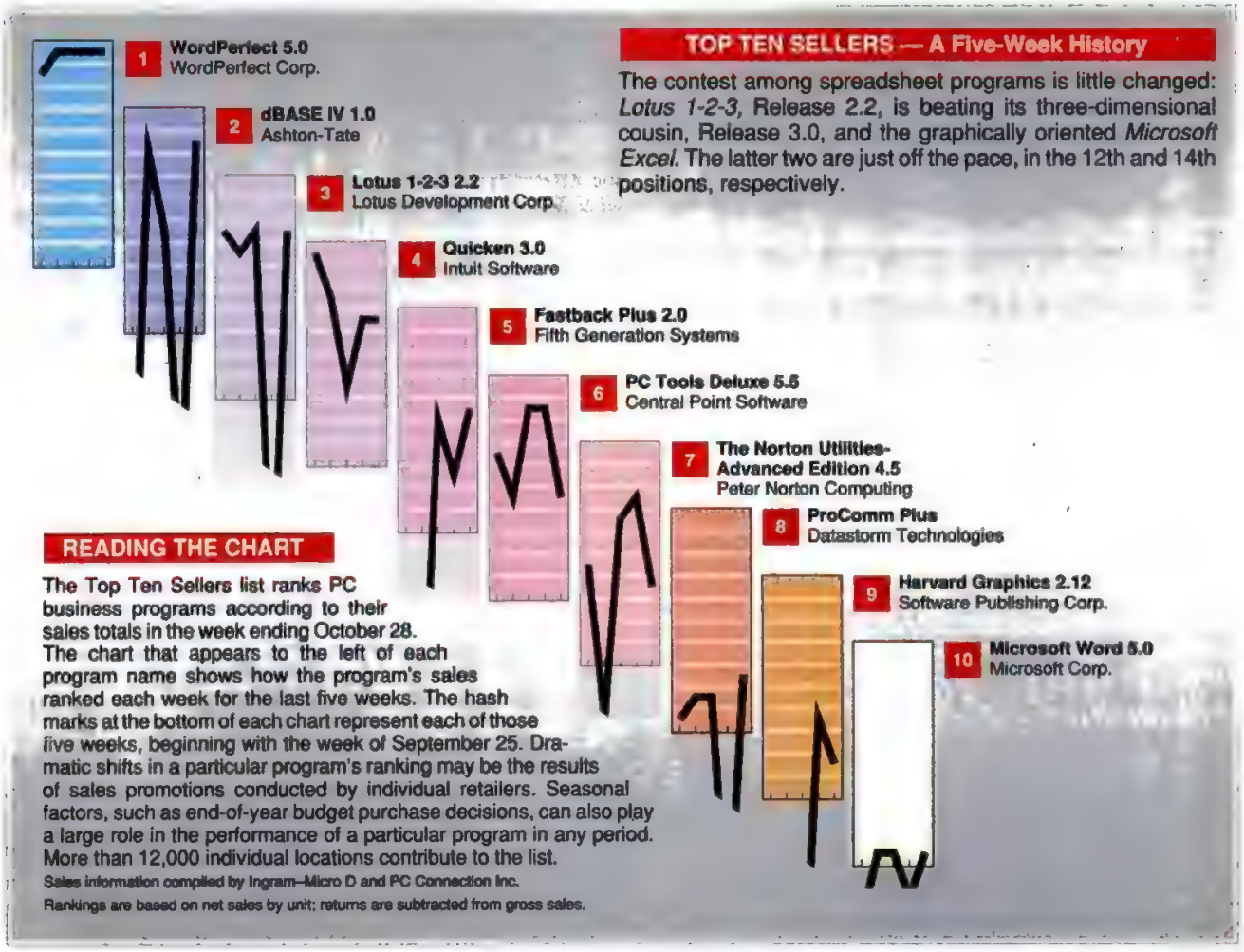


Pipeline

CONTINUED FROM PAGE 63

200,000 copies each season, so it was only a matter of time before someone raised the stakes.

MECA Ventures hopes to grab market leadership this year by merging the *PC/TaxCut* and Andrew Tobias names and replacing the core program with a stunning new design that was the core of *Ask Dan About Your Taxes*.

Answer man Dan Crain, a tax attorney with a flair for Turbo Pascal programming, was only too happy to give up the headaches of building a small software business to give his program the benefits of MECA's marketing ability (Crain's program wasn't distributed through stores last year; you had to order it through his Newton, Massachusetts, company).

So instead of working alone this year, Crain sat down with Tobias and incorporated some of Tobias's ideas into his design. The result, a revised *Andrew Tobias' TaxCut*, is an even stronger tax-preparation system that will pop up expert tax advice on top of fill-in-the-blanks tax forms.

A full review of the new package will appear in *PC Magazine*'s After Hours section soon after this year's version is completely finished; to give you an idea of how much advice the program gives you, there's an Audit flag that will alert you to items that could trigger an IRS spotlight. Or if you just want to know what the IRS means when it refers to Earned Income Credit, you can call up an explanation.

Until Dan Crain built explanations into his program, you had to rely on the government's booklets, or if you used *J.K. Lasser's Your Income Tax*, the software referred you to a relevant paragraph in a textbook-sized printed guide that was sold with the program. This year, *TurboTax* is addressing the need for plain advice by including *The Price Waterhouse Tax Advisor* with the program.

The goal is to establish protocols that any PC database can use to find a record on an SQL server.

ChipSoft has a lot riding here, and while it's too late for the company to make major changes to the program this season, ChipSoft will have to start thinking about raising the stakes for next season before April 15 rolls around.

Group Forms to Ease Transition to SQL

.DBF files and *dBASE* code are still the standards for PC databases, but connected offices will need more-ambitious standards if they're going to let big networks hammer away at shared files.

SQL is the odds-on favorite to become the query language of choice for databases on servers. But unless you want to start importing files and translating code to work with an Oracle or Informix engine, you won't have an easy job of making the switch.

A new group was formed by some of the vendors with the most at stake in this evolution. Called the SQL Access Group, it's being run by representatives of Informix and DEC and has the support of Ashton-Tate, Oracle, Metaphor, Sun, and Hewlett-Packard. The goal is to establish protocols that any PC database can use to find a record on an SQL server.

ANSI (the American National Standards Institute) has a committee that's handing down procedures for SQL vendors, but this group wants to ensure that developers get a clear set of rules when they develop front-end applications.

Most developers fear that if they don't take the reins now, they'll soon be at the mercy of the vendors most likely to set out in front: Microsoft and Ashton-Tate.

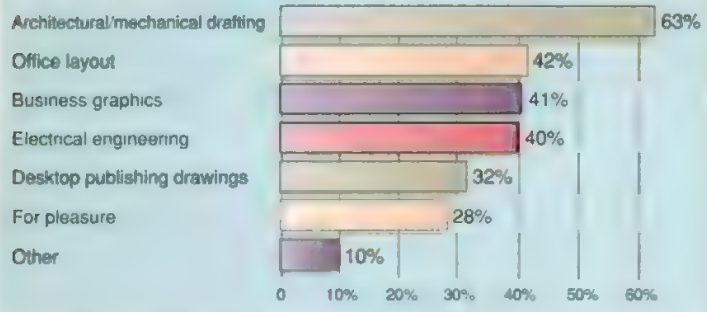
A guidebook should be published in early 1990. ■

SURVEY

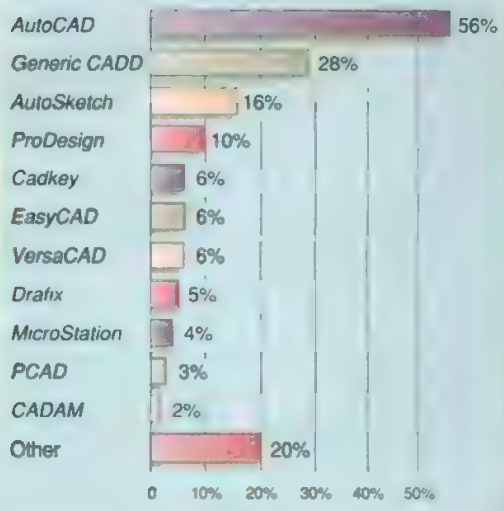
Last year, we asked callers to PC MagNet to categorize their use of CAD software (see Pipeline, *PC Magazine*, January 31, 1989). We checked in again recently and found a couple of changes: office layout and desktop publishing drawings have both become popular uses.

These figures were tallied from the 60 percent of the 754 callers who said that CAD programs were used in their company.

What is CAD software used for at your company?



Which CAD programs are currently used at your company?



BRIDGES

The *easy* way to move files between the 5¼" world of PCs, and the 3½" world of PS/2s, Laptops, and 386s: Sysgen's Bridge family.

Because your PCs, PS/2s, 386s and laptops all talk to different floppy disk sizes and formats, they can become frustrating *islands* of information.

For the simplest way to get files back and forth, just install Sysgen's Bridge products. Presto: Your different computers can talk to common diskettes.

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Solution 1: Our Bridge-File 5.25 floppy disk drive.

A best seller, with over 50,000 installed. Attach it to your PS/2, and you can read and write files from PCs. Critics and users alike have raved about its small footprint, ease of use, and dual density capacity of 360Kb and 1.2Mb. (IBM's drive is twice the size, yet stores only one-fourth the data.)

Every PS/2 user deserves this easy connection to the world of PCs.

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Now all your PCs can share files with your newer systems.

And here's the ideal controller: The Omni-Bridge Controller.

Controls up to four drives, so you can mix and match 5¼", 3½", and floppy tape drives as you need. This hot card gives you big storage, plus twice the floppy disk and floppy tape transfer performance rates! At only $95, this is a winner.

Get your computers talking. Call the Sysgen Hotline for the name of your nearest dealer. 1-800-821-2151.

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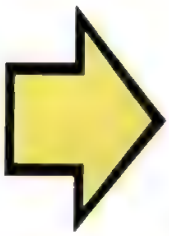
ClipArt from A to Z.



A is for Arrow

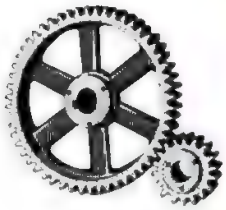
B is for Baseball

C is for Cartoons

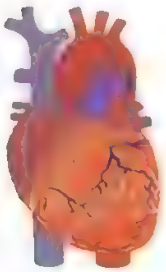
D is for Dinosaur

E is for Easter

F is for Flags



G is for Gears

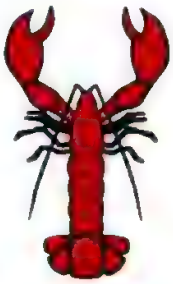


H is for Heart

I is for Ice Cream

J is for Jet

K is for King



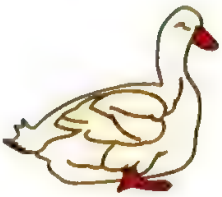
L is for Lobster

M is for Motorcycle

N is for Nutcracker

O is for Olympics

P is for Penguin



Q is for Quack

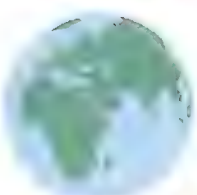
R is for Reagan

S is for Santa

T is for Texas

U is for Uncle Sam

V is for Valentine



W is for World

X is for X-ray

Y is for Yacht

Z is for Zip Code

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Bill Machrone

Sometimes software can be too helpful. Just because a product helps you type faster doesn't mean it will help you write faster.

Suppose I offered you a program that let you type 200 or more words per minute. Suppose it corrected your spelling as it went. You'd jump at it, right? Wrong. Several such programs exist, but they're languishing. It's not that they're new or secret. You could find them if you were looking for them. The question is why you aren't looking.

The first program I saw was *MindReader*. It was written by Kalman Toth, who had the entrepreneurial zeal necessary to champion a bold new idea.

MindReader is a word processor that watches your keystrokes and tries to figure out what word you're trying to type. It refines its choices as you get farther into the word, and it keeps track of the frequency with which you use certain words. It puts a window onto the screen with what it considers the likeliest choices. You press the number of the desired word and it gets inserted into your text.

MindReader offers the word you're looking for surprisingly often. If it's not the first choice, it's usually one of the others in the box. Rarely is the program stumped, and even then, it can learn new words from you and offer them back with consideration given to the frequency with which you use them.

Using *MindReader* results in effective typing speeds in the hundreds-of-words-per-minute range. And, of course, every word it completes is spelled correctly. Sounds like heaven, doesn't it? But *MindReader* sold poorly. It was marred by sound effects and screen displays that lent a video game–like atmosphere to the otherwise mundane job of word processing. (Later versions let you disable the sound.) Such tricks sent the wrong message in a market that was trying to convince management that PCs were serious business machines. Toth finally gave up on the product and remanded it to Brown Bag Software, which sells it as shareware.

The next big effort to crack the typing speed barrier was *PRD+*, offered by Productivity Software International, the same group that has dominion over Stenoscript. You remember Stenoscript—those matchbooks that said, "IF U CN RD THS U CN GT A GD JB." Stenoscript is still taught in secretarial schools, and it really works. Central to its effectiveness is a standard way of abbreviating prefixes and suffixes on root words or abbreviations that suggest root words. After learning the method, any Stenoscript-trained person can read or transcribe another's notes.

OVERCOMING OBSTACLES

PRD+ lets your computer comprehend Stenoscript. It's a memory-resident program, so it works with most popular software. You can even use it at the DOS prompt to abbreviate lengthy DOS commands. Like *MindReader*, *PRD+* boosts typing speeds to hundreds of words per minute. But like *MindReader*, it isn't doing as well as you might expect.

Some of the impediments to the success of these keying accelerators are obvious. Both products require that proficient typists relearn or modify their skills. The hunt-and-peck typist may be thankful for the assistance; everybody else just gets annoyed.

ILLUSTRATION: TOM LULEVITCH

But people can, in fact, retrain themselves, just as they can find and operate the different light switches and door handles in Ford and GM cars. So that alone wouldn't be enough to explain the relative lack of acceptance of such productivity-enhancing software.

The real obstacle goes deeper, and it involves the way people learn and think. There's no doubt that shorthand is more efficient than longhand. Yet we don't learn it in school. It's

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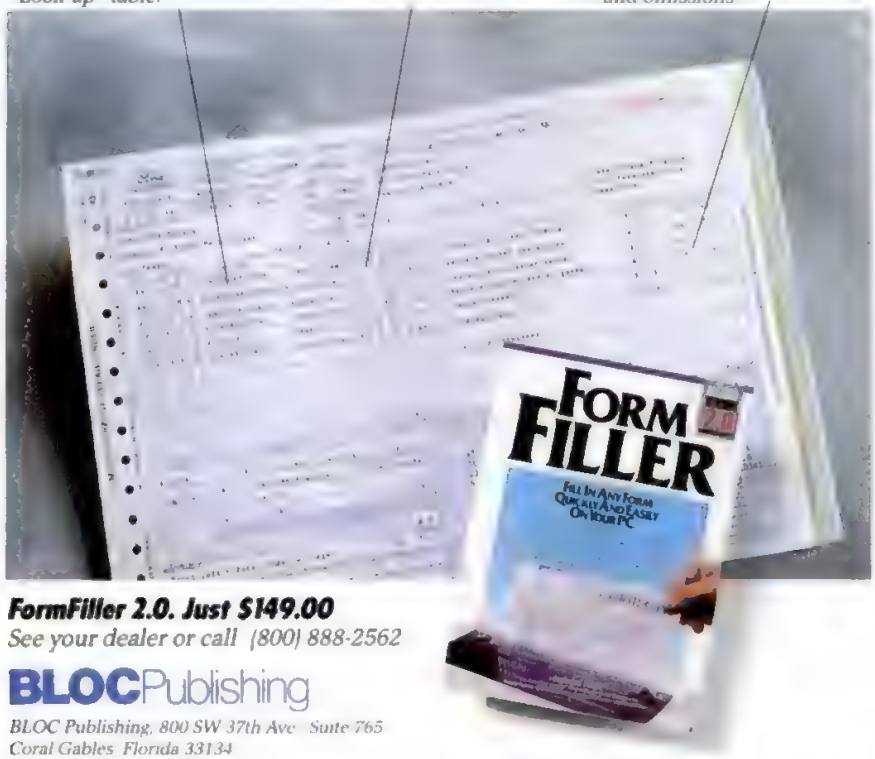

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Bill Machrone

the province of secretaries trained to take dictation, and even there it's a disappearing skill as more executives learn to type.

Managers and professionals don't use shorthand because it interferes with the thinking process. When you're writing, you're really not thinking about the spelling. The words just flow out of your fingers in response to the images forming in your mind. In a multilevel process, you superimpose a sentence structure on the images, and rough outlines of the sentences to follow form in your mind. The slowest aspect of the process is the time that it takes to get the words out. The process is interactive. The words we choose to best represent the images in our minds cannot help but modify the images.

NOT WITHOUT REASON

E. D. Hirsch, Jr., has written a wonderful treatise on the broader aspects of the process in his book *Cultural Literacy*. Language, he notes, is powerfully evocative. We're continually thinking in terms of the images and associations that the words we use invoke. In fact, comprehension of language is utterly dependent on context.

This may seem blindingly obvious, but the breakthrough is that Hirsch and the many researchers he draws upon have found ways to prove the assumptions and measure the effects of style and context on comprehension. Hirsch points out that recognizing uncommon words requires a significant expenditure of mental energy. For example, it takes much longer for people to agree that "a chicken is a bird" than it does for them to agree that "a robin is a bird." Small wonder, then, that a program that requires you to substitute an abbreviation for a word or to choose from a list of completed words will interfere with creative flow.

PRD+ and *MindReader* tend to distance us from the context of the language by forcing us to think about abbreviations or by interrupting us. Does that render products of their ilk valueless? Hardly. While I think they're unsuitable for the creative process, in which style and flow are critical, they're invaluable for high-volume typing. We all contend with boilerplate writing in our work. Products such as *MindReader* and *PRD+* get those words onto paper faster and more easily. Give them a try—but only in context. ■

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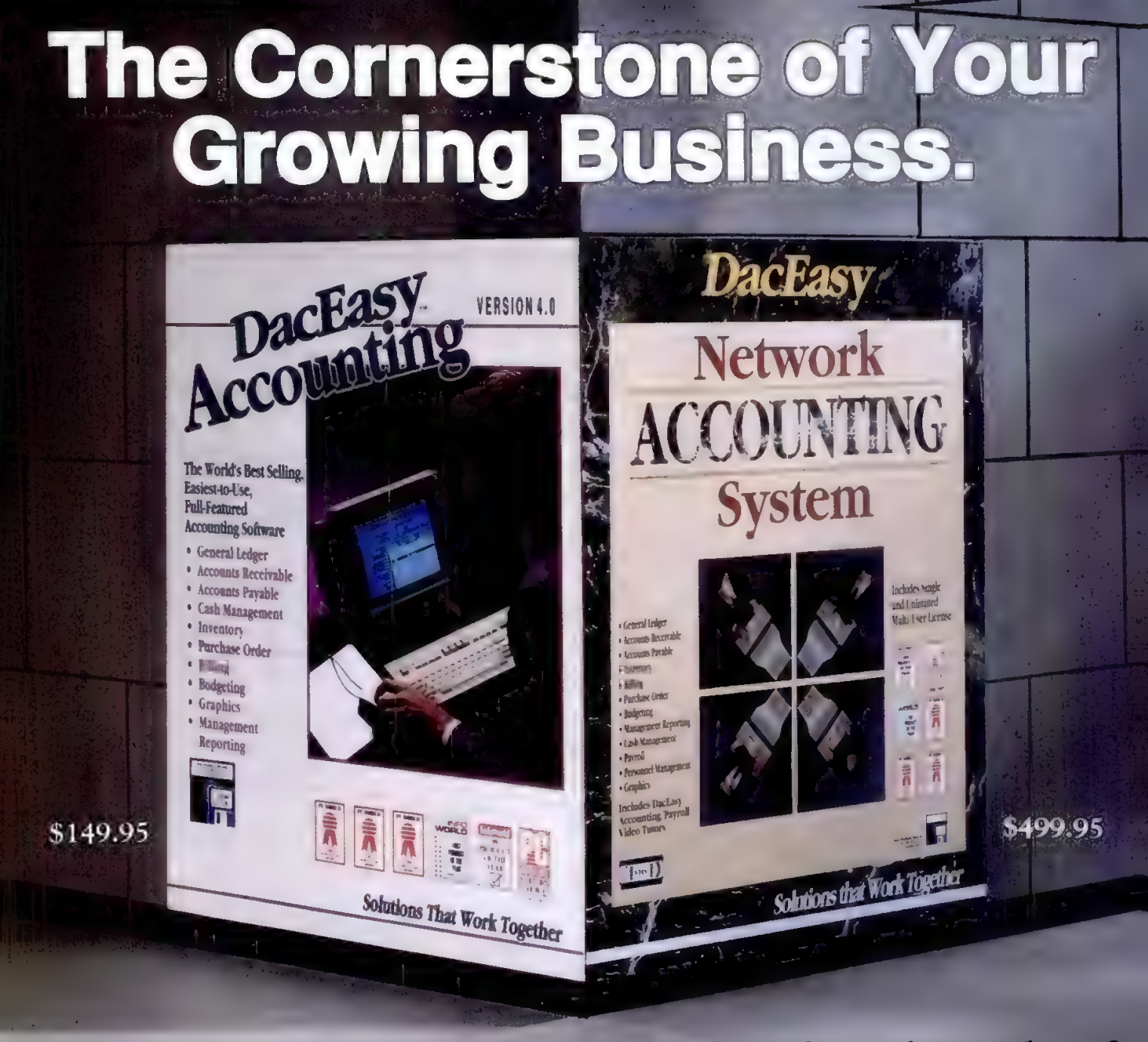

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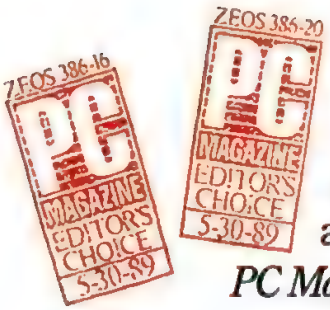

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John C. Dvorak

In the olden days, everyone could look to IBM for guidance. We're now starting to find out just how important its leadership was.

The earthquake in the San Francisco Bay Area was a sociologist's dream come true. The entire populace experienced panic at the same time. They then faced the aftershock of depression and trauma. Among the debris and the anxiety of the man on the street were the heroes, the take-charge types, the leaders. I was impressed by the ability of certain people to take a leadership role under stress and adversity. Tales are still told of the guys who rescued people in the collapsed freeway.

One of the most outstanding was Art Agnos, the mayor of San Francisco, who was in among the ruins of the San Francisco Marina district day in and day out, a steady, calming influence. One night as I watched him and thought about other symbolic leaders such as ex-President Ronald Reagan who, if nothing else, projected an important image of assuredness to a panicky public, I realized that the PC business needs a leader badly.

When IBM's Entry Systems Division in Boca Raton came on the scene with Don Estridge at the helm, there was leadership. There was an impression that IBM knew what it was doing in the personal computer market. It came in with teams, expertise, open architecture, and a positive attitude. Even when it flubbed, it gave an image, a perceived image, of leadership.

In fact it's kind of amazing how many flubs IBM managed to make. There was the PC*jr.* with its Chiclet keyboard, the IBM Portable Computer, the original IBM AT with its faulty CMI hard disk, the IBM PC Convertible, the IBM modem, IBM retail stores, and *TopView*, to name only the most important.

But through all these fiascoes, IBM's image and role remained that of a leader. This meant that IBM was a Teflon company. After all, a leader is bound to make more mistakes than a follower, and as long as IBM was leading the pack, it could make an infinite number of mistakes without any real blow to its reputation.

During this period nobody noticed that many of IBM's mistakes were ludicrous. The IBM Portable Computer was nothing but a copy of the Compaq machine, and it wasn't as good. The PC Convertible wasn't as good as the laptop machines already released by the competition. And the IBM modem was like something invented by a man from Mars—it wasn't even Hayes-compatible.

OUT OF TOUCH

Leaders have to be aware of the troops they lead, but IBM seemed oblivious to them. It then switched to a new architecture, and suddenly everyone realized that IBM had abnegated the role of leader to whoever wanted to pick up the flag. Whatever forces within that mighty corporation had turned it into a leader of the computer proletariat had forever disappeared. Once again, IBM resumed its old role as a tough old coot of a massive corporation. It sneered at its erstwhile leadership role, and cut loose the followers who looked to it for efficient de facto leadership and focus.

Set adrift, the personal computer industry hasn't produced any kind of true leadership to replace IBM's. Compaq seems to be the center of attention nowadays, but it doesn't have the intimidating magic of the old ESD folks. Bill

ILLUSTRATION TOM LULEVITCH

Gates is in many ways the intellectual leader of the industry, but the image he projects is of someone interested in the success of only one entity: Microsoft Corp. Gates looks like a pied piper who's too smart and talented to be trusted.

So where is the great leader? In San Francisco the leaders appeared only during disaster. Things are still going too well in the computer industry for a leader to appear. This business needs an earthquake.

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John C.
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Inside Track

Everyone is talking about *Microsoft Windows* 3.0, but not all of the talk is pleasant. It seems that Microsoft's sudden reemphasis on *Windows* may result in even **more grousing** by developers who have put their hopes into OS/2. *Windows* 3.0 now looks like the hot ticket to the future.

According to one Microsoft source, the company's employees **switch** between *Windows* and OS/2 on their own machines. *Windows* has been the system of choice since its inception. More recently, as OS/2 has progressed, many began to switch to it. Just as critical mass was approaching, suddenly along comes *Windows* 3.0. Now I'm told Microsoft employees have gone **back to** *Windows* en masse. Of course, it's still up in the air whether or not the public buys into *Windows*.

Microsoft's sudden reemphasis on *Windows* makes the program look like the hot ticket to the future.

What Windows Needs to Be a Success Dept.: Here are my recommendations: (1) Better appearance. Supposedly, Microsoft is consulting with San Francisco's Susan Kare, the talented superstar artist who is credited with designing the entire Mac screen "look" and much of the look of the NeXT interface. This step will help only if they take her advice. (2) Ability to run plain-vanilla DOS applications without noticeable **degradation.** As it now stands, *Windows* slows the performance of regular DOS applications to such an extent that few users are willing to put up with it. One theory has it that Microsoft will just wait for the 586 and let hardware correct the performance gap. (3) **High-performance** multitasking including telecommunications as a background task. (4) Improved ease of use. The MS-DOS Executive interface is not as intuitive as it should be.

Genuinely Interesting Newsletter Dept.: If you are in the hardware business as a manufacturer or even an interested hobbyist, you **must** obtain a subscription to *Microprocessor Report*. This is the "in" newsletter for hardware hacks. In 1990 it will become a twice-monthly $395 hit. It's one of the few $395 hits that's worth every penny. *Microprocessor Report*, 550 California Ave., #320, Palo Alto, CA 94306; (415) 494-2677.

Microprocessor Report is where you can get the inside scoop on the Intel 486 and the **Motorola 68040,** as well as the interesting rumor that the designers of the i860 are going to quit Intel to go out and do board-level design using the new chip. That might put **a crimp** in the design of the i960, but it will get the i860 more exposure. The i860, which was raved about in mid-1989, is hardly discussed anymore.

The *Microprocessor Report* also holds an **annual forum** (who doesn't?). It differs from all the other me-too forums, however, in that the speakers do not include Bill Gates, Philippe Kahn, Rod Canion, and John Sculley all giving their same old canned speeches. The crowd appears to be a **slew of nit-picking superstar techies** from all the chip companies who love to argue about everything. An engineer's version of a pro wrestling Battle Royale. The last guy left in the ring wins.

While on the Subject Dept.: This brings up the sore subject of **second sourcing.** It's always been traditional for a chip designer to license its designs to other chip makers so that customers can be assured of a constant supply of chips. This is a courtesy. Say, for example, that Intel had been decimated by the last earthquake. Would the whole PC world come to a standstill if the company were **destroyed** and its entire inventory of 386 chips melted?

Of course, Intel sees it differently. They've invented a **cash cow,** and they figure on being its only milkers. What bothers me about all this is the newest gambit by Intel to **sink the 286 business.** Maybe I'm too moralistic, but it seems that Intel invented the 286 and licensed it to other vendors to help establish a market for the chip. When the 286 was released, the company extolled its virtues, didn't it? Now, because other fabricators (namely Harris and AMD) make the chip **better** and more efficiently than Intel, Intel will do a negative publicity campaign to turn people away from the chip.

Hey, the 286 isn't my chip of choice. But it's a lot better than the 8088 or the 8086, neither of which do I see Intel condemning. What **galls me** in all this anti-286 publicity is that Intel invented the chip in the first place and Intel told us how great it was way back when. Now it's telling us that it's a dog. What kind of game is this, anyway? **Will the 386 be a dog too?** The 486? It seems to me that the 286 was invented for a purpose by people who worked for the company to create something better than the 8086. Is their work for naught? I can't imagine being a design engineer for the 286. I'd be praised one minute, then made the fool the next minute. This is not a good sign.

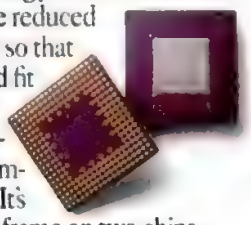
While Intel still, in my mind, makes the best microprocessors, the idea behind microprocessors is no longer a **dark secret.** Motorola, NEC, Fujitsu, MIPS, Sun, and plenty of others are designing microprocessors. Once upon a time, a newcomer by the name of Zilog came along, and way back then the 8080 was the king of microprocessors. In no time flat, Zilog with its Z-80 took the sandwich right out of Intel's mouth and **began to chew.** Luckily for Intel, Zilog was owned by an oil company, Exxon. These guys didn't know what they were doing in data processing and self-destructed.

Observers saw what happened, though. Intel was **vulnerable** then, and it's vulnerable today. ■

1 The NeXT™ Computer System is the first computer in the world (and so far the only) to use read/write/erasable optical storage. While PCs today are typically equipped with Winchester drives that store 20 to 40 MB, a single optical disk can store 256 MB. Plus, it is removable, for portability and added security. This dramatically new technology provides storage that is simultaneously vast, reliable and cost-effective—a combination unmatched by computers of any size.

2 NeXT has made the power of UNIX® usable by mere mortals. UNIX is the high-performance operating system used by workstations to achieve true multitasking and superior networking. Unfortunately, it has always been the antithesis of user-friendly. NeXT has given UNIX a revolutionary new interface—one that is both visual and intuitive. Now computer users of every level can instantly wield this tremendous power, with no technical knowledge whatsoever.

3 To achieve the power needed for the 90s, NeXT bypassed traditional workstation architecture and went directly to that of a mainframe. This eliminates bottlenecks and attains an extraordinary level of system "throughput"—the true measure of computer performance. Only through the use of VLSI (Very Large Scale Integration) technology could this architecture be reduced in size so that it could fit inside a desktop computer. It's a mainframe on two chips.



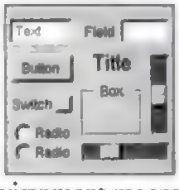
4 While PostScript® has long been the industry standard for printing, NeXT has made it fast enough to also be used on the display. This "unified imaging model" ensures that what you see on the display is precisely what you will get on paper. All your work, in any size type and any degree of rotation or magnification, appears with perfect 92-dots-per-inch clarity on the NeXT MegaPixel Display. And with laser precision at 400 dpi on the NeXT Laser Printer.

IN THE 90s, WE'LL ONLY TEN REAL BREAKTH HERE ARE SEV

5 The NeXT Computer System is the first to be capable of producing CD-quality sound. Without requiring any additional equipment. This feat is made possible by a chip that has been specifically designed for the task of manipulating sound–the Digital Signal Processor (DSP). Because this processor is standard in every NeXT machine, software developers will be able to call upon its power to enrich programs we use every day. Now computers will not just be seen, but heard.

6 NeXT Mail takes electronic communications beyond anything you've seen on a personal computer before. Now you can send and receive multimedia mail–including text (with varied type fonts, styles and sizes), graphics and voice messages. And despite its high level of sophistication, NeXT Mail is so intuitive, you may not ever need to open the manual. NeXT Mail is built into the system, along with Ethernet and TCP/IP, so the NeXT machine can quickly become a part of existing networks.

7 Programmers can create software on the NeXT Computer up to ten times faster than on any other computer–the result of a breakthrough called NextStep.* It gives software developers the power to create the graphical user interface portion of their applications (often the most time-consuming and difficult part) without any programming at all. This revolutionary environment means we will see more programs, and better ones, in less time than ever possible before.



These seven breakthroughs will change the way we use computers in the 90s. Which is why Businessland, the leading supplier of computers to corporate America, chose the NeXT Computer System as the workstation they will offer. Call us at 800-848-NeXT, and we'll send you a 28-page brochure describing the NeXT Computer. We'll also give you the address of your nearest Businessland Center. There, you can experience for yourself the first seven breakthroughs of the 90s. And get a good idea where the next three will come from.

L PROBABLY SEE ROUGHS IN COMPUTERS. EN OF THEM.

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Jim Seymour

The PC market in the 1990s will present a brave new world of multimedia and enterprise systems.

Columnists love to play the role of seer, and few opportunities to gaze into the crystal ball are so beloved as the year-end essay forecasting the next 12 months' events.

This year, though, we have a chance to leap beyond the usual ruminations, jumping an order of magnitude to a decade hence. This issue marks the beginning of the 1990s: the second decade of IBM-style PCs and, I believe, a time of fundamental change in how PCs will fit into our culture.

Join me for a look at some of the changes I believe lie ahead of us in using personal computers—and in understanding their role—in the 1990s.

We'll move beyond personal productivity. Throughout the 1980s, the focus has been on PCs as tools for increasing personal productivity, as levers for one mind at a time.

Look around you: that work is largely done. From the routine to the conceptual, the PC has become the most powerful and most nearly ubiquitous tool that has ever existed for the empowerment of the individual.

The focus of the 1990s will be almost wholly on empowering *groups* of people in the same way. Of course, part of this task will consist of providing levers for the collective minds of "workgroups," about which we hear so much today. But long before the '90s are over, the focus will have moved on to applying that leverage throughout the enterprise, helping entire populations—college faculties, corporate staffs, community groups—to work more smoothly, more *effectively* . . . together.

This isn't one of those lamentations that we're about to "lose the 'personal' in personal computing," but the very opposite: a *cri de coeur* that we carry the vision beyond our desktops to our collective enterprises.

Multimedia PCs will be very important. Though there's a lot of sloppy talk about the imminent importance of multimedia in PCs, three things must happen before multimedia PCs become a market force.

First, Microsoft must ship the new "multimedia" version of DOS it now has under development. Second, IBM must ship its new line of multimedia PCs, incorporating superior sound, color graphics, and internal data/audio/video CD-ROM players (DAV-CDs). And third, external add-on DAV-CDs must appear on the street at reasonable prices—in the $300 to $350 range.

Those pieces of the puzzle will begin falling into place in 1992. From interactive tours of history to really engaging academic coursework to build-your-own models and simulations to *dazzling* games, multimedia PCs will bring incredibly sophisticated computer technology into far more homes than the "home computer" boom ever did.

A small risk could delay but not stop this juggernaut: if IBM fails to break out of the kind of blue-serge thinking that produced the PC*jr*, we may see a "Multimedia jr" that will be as big a dog as the first IBM home-market entry.

MONOCHROME RULES

Portables get lighter, smaller, faster—but remain monochrome. The portable PC business will continue to boom throughout the 1990s. That market has already divided into notebook-size machines and heavy, bulky, but powerful "desktop laptops." That split will continue, with most of the R&D energy and customer interest going into the smaller, lighter models.

ILLUSTRATION: TOM LULEVITCH

Color displays on laptops will be nonstarters for years to come, however, because their increased size, weight, cost and power consumption run precisely contrary to the four

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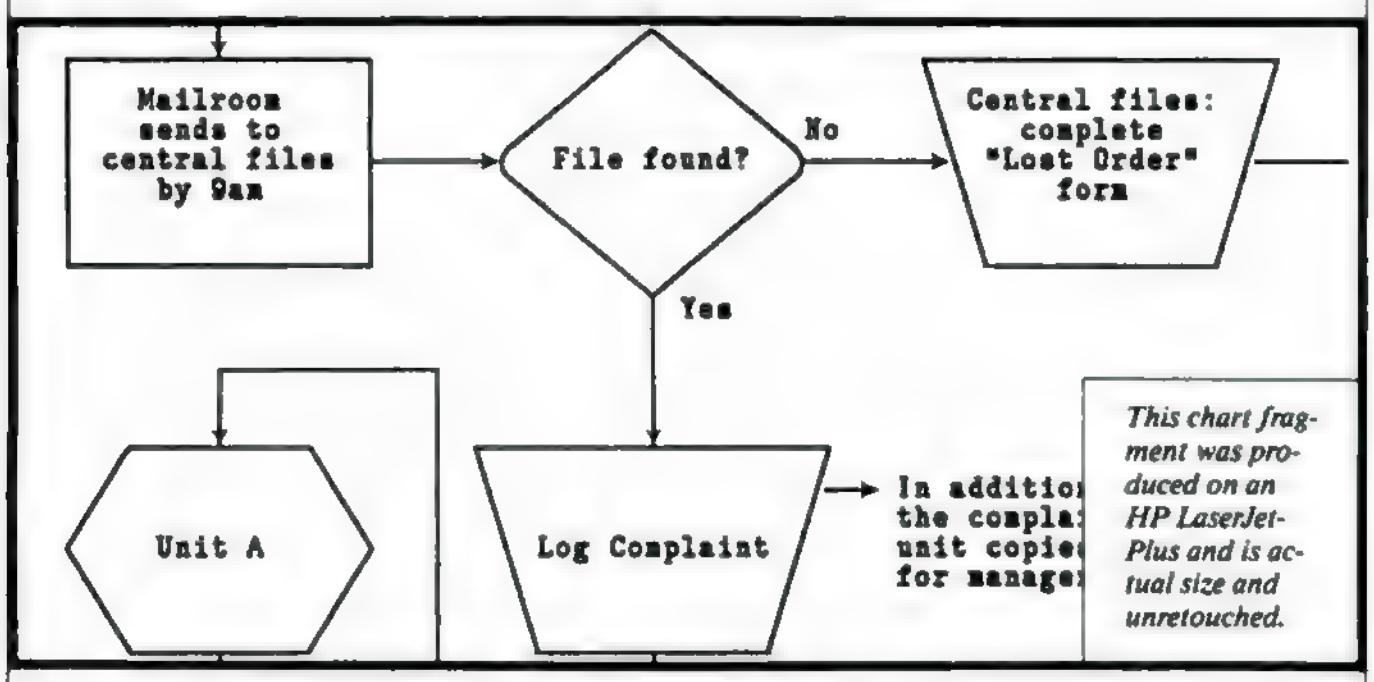

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CIRCLE 201 ON READER SERVICE CARD

Jim Seymour

design imperatives that drive the portable marketplace, which are to make portables lighter, smaller, less expensive, and longer-lived.

Desktop presentations won't amount to much. Despite the hoopla, the desktop presentations market isn't going to be a big one. Creating images on PC screens and turning them into standard 35mm film slides will virtually wipe out traditional means of creating slides for business presentations. But watching those slide shows on PCs isn't going to be very common.

Instead, presenters will rapidly move toward the use of tiny, hand-held 8mm video players such as Sony's Video Walkman. These handy units offer all the production options of studio-quality video, but allow you to show the finished presentation either on a hand-held VCR for one-on-ones or, for larger groups, on any television set.

IBM's current economic woes will continue—but don't view IBM as a barometer of the PC industry's health. Many seers have gotten so used to following IBM's ups and downs, and extrapolating from them visions of the computer marketplace as a whole, that they've missed the dawning of the essential truth of the 1990s: IBM is almost irrelevant to the PC market.

The shift in American business from the centralized "data-processing warehouse" model to seeing computer power distributed across desktops is moving faster and farther than IBM can cope with, or even respond to.

IBM's current economic distress is going to worsen over the next two to three years. But that distress is almost the inverse of the vitality of the PC business. The faster American business moves toward PCs, the worse it will be for IBM . . . and the better it will be for the rest of the industry.

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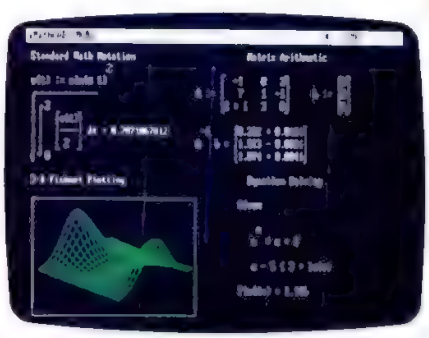

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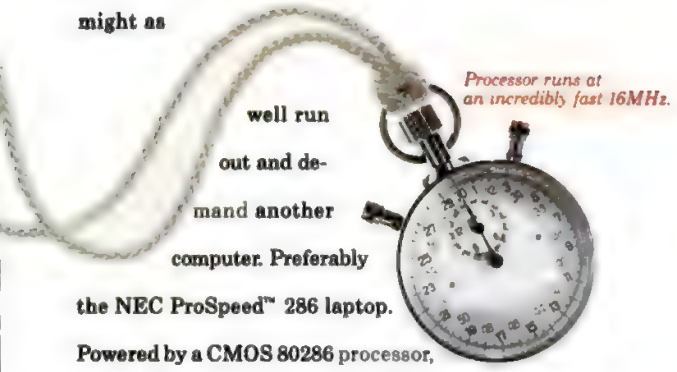

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But perhaps the most powerful statement is this: quite simply, it's the most powerful 286 laptop you can buy.

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An awesome power of display.

Undoubtedly, the most important element of a laptop computer is its screen. After all, if what you're looking at isn't very clear, then clearly you need another computer. Preferably the NEC ProSpeed 286.

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Paper-white screen with VGA resolution

And with more and more people moving towards advanced graphics-oriented applications, the case for the NEC ProSpeed 286 becomes even clearer.

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CIRCLE 285 ON READER SERVICE CARD

William F. Zachmann

The seer gazes into his crystal ball. What he finds there may surprise you.

Wow! Is it really 1990 already? Since this issue of *PC Magazine* marks the first anniversary of this column, I'd like to celebrate by reviving an old tradition of mine: making 13 predictions about the way the industry will be going in the coming year.

Like an old shaman who can't give up the rituals because he doesn't want the visions to stop, I've been itchin' to gaze into the cloudy crystal once more. So I'm sticking my neck out again, in the best tradition of Merlin the Magician. But this time, I'm doing my annual soothsaying right here in *PC Magazine*, where all the most important and influential readers in the industry can read it. So, here goes.

Prediction 1: Market focus will move to mainframe and minicomputer replacement. So far, the primary emphasis in personal computer use has been on enhancing individual productivity. But with the advent of local area networks and powerful microprocessor-based network servers, personal computers are now capable of doing much if not all of what expensive mainframe and minicomputer systems have done in the past, at less cost. In 1990 this trend will move to center stage.

Prediction 2: High-end systems will be more affordable. Market pressures, more competition, and increased supply, coupled with softening demand and the Apple/Microsoft challenge to Adobe's control over PostScript, will drive down prices on 386-based systems, DRAMs, and PostScript or equivalent printers. This means that more-powerful and -capable systems will be within reach of a growing number of users. By the end of 1990, the price of hardware needed to run the new, more powerful software will no longer be a serious obstacle for most business users.

Prediction 3: OS/2 will take off. Lower hardware costs, great new applications, printer drivers (finally!), and continued improvements add up to the right combination for making OS/2 "ready for prime time." By the end of 1990, many more users will be running OS/2 than most pundits predict. The speed of its acceptance is just as surely underestimated today as it was overestimated in 1987.

Prediction 4: Windows will be closing. For all the recent talk about *Windows* slowing the acceptance of OS/2, the year ahead will make clear what should have been clear all along; namely, that *Windows* is strictly a transition product. Important as *Windows* has been in keeping the promise of OS/2 alive over the past few years, its time is slipping past already. Sure, lots of *Windows* applications have a great future—as OS/2 applications. Whatever *Windows* does, OS/2 will do better.

Prediction 5: Unix will continue to go nowhere on the desktop. Where applications on multiple terminals make sense, Unix makes sense, as an alternative to proprietary operating systems. But for single-user office systems, Unix is no more than a sideshow. The invasion of Unix workstations that didn't happen last year won't happen this year, either.

Prediction 6: EISA will be coming on strong. After lying fallow for most of 1989, the Extended Industry Standard Architecture (EISA) bus specification is ready to take the field, and it will do so with considerable success. Since

ILLUSTRATION TOM LULEVITCH

Micro Channel couldn't establish itself as the next industry standard while EISA was vaporware, its prospects for dominance can only diminish now that EISA has become a real product. In 1990 it will become evident that Micro Channel is destined to be IBM's architecture. EISA will be the standard 32-bit architecture for just about everybody else.

Prediction 7: In application software, 1990 will be a tough year for the leaders. The tran-

William F. Zachmann

sition to OS/2 and the Presentation Manager is going to cause difficult times for Lotus, Ashton-Tate, WordPerfect, and Novell. Problems adapting old products to new environments, and challenges from competitors with products designed for those new environments, will cause trouble for these traditional market leaders.

Prediction 8: OS/2 Extended Edition and OfficeVision will tread water, at best. The rapidly accelerating success of OS/2 in 1990 will do little for Big Blue's vision of the office of the future. Both OS/2 EE and OfficeVision cost too much and deliver too little to appeal to any but the most dedicated followers of IBM. OS/2 EE will be more successful than TopView and the PC*jr*, but not by much.

Prediction 9: 1990 will be a banner year for intellectual-property lawyers. Look for the already tangled morass of copyright and patent lawsuits to get even murkier and more unpleasant in 1990. In a typical display of escalation at work, nearly every hardware and software vendor is scrambling to establish as many "intellectual property rights" as possible. With this sort of legal arms race under way, open warfare is inevitable. For vendors, "If you can't beat 'em, sue 'em!" will be a battle cry in the early '90s. For users, it will be a royal pain in the neck.

Prediction 10: Network servers will make big gains. These large and powerful boxes started arriving on the scene a couple of years ago, but 1990 will be the year that they really hit their stride. Running OS/2 or Unix on single or multiple microprocessors, network servers deliver PC price/performance levels in packages big enough to take on the transaction volumes, database sizes, and computation loads previously reserved for mainframe and minicomputer systems. They will be one of the most rapidly growing hardware categories of the 1990s.

Prediction 11: 1990 will be a hard year for Apple. For the past three years, Apple has enjoyed the advantage of having IBM's sales organization sing the praises of graphical user interfaces. Lots of Apple Macintosh computers made it into corporations because IBM-compatible systems couldn't do what the Mac could. But as OS/2 and the Presentation Manager begin to take off, Apple's proprietary, closed architecture will start to close that door. The result is likely to be the most difficult year for Apple since the crisis of 1985.

Prediction 12: NeXT won't be. The NeXT machine provides a useful stimulus to the industry, but it just isn't going to be the new Macintosh that Steve Jobs and his investors are hoping for. NeXT will make it into the Boston Computer Museum. NeXT may make it into the Museum of Modern Art. But NeXT won't make it into the offices of enough customers to pay for its development.

Prediction 13: IBM's turnaround won't happen this year, either. Since its 1984 peak of $10.77 per share, IBM's earnings haven't come near that mark. Even during the Great Depression, IBM's financial results were never so dismal. And the early 1990s are going to be even tougher on IBM. Those who are following IBM's lead will do well to look very carefully at where they're going. ■

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CIRCLE 496 ON READER SERVICE CARD

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CIRCLE 167 ON READER SERVICE CARD

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Wait State	0	0	0	0	0
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CIRCLE 383 ON READER SERVICE CARD

Stephen Manes

The Nineties are upon us, and so are the prognosticators. What wonderful improvements and unexpected changes will the new decade bring? Remember, you read it here first!

Let us be the 7,426th to welcome you to the 1990s. Amazing: While you were sweating named ranges over that desperate last-minute scheme to divert your gushing 1989 income stream far into the drought-ridden future, the decade changed on you.

(Memo to professional letter-writers: Yes, I know the decade didn't *really* change. Since there was no year zero—though you will get some dispute on this from programmers, who believe *everything* starts with zero, especially when it comes from the sales department—new decades, strictly speaking, begin with years ending in 1. But only pedants and doofuses adhere to this usage, so please direct your letters to the *MLA Journal*, *Mad* magazine, and Edwin Newman. Also the ones about *baud* versus *bps*. Thank you.)

The arrival of a new decade brings the promise of massive change. The Sixties were, of course, the decade of space exploration, eventually leading to such pivotal spinoff achievements as Tang and the Houston Astros. The Seventies, the Watergate/Carter years, brought new prominence to Georgia and impeachment. In the 1980s the major news was, of course, the exponentially increasing power of the personal computer pundit.

Computer soothsayers are now rushing to take advantage of the business opportunity the new decade presents. For example, just missing the Pipeline and David Letterman's Top Ten this month is The Computer Pundit Association's *PowerNamer 2000*, a *WordStar 2000*–compatible program that lets even novice prognosticators christen conference sessions with such provocative, attendance-boosting titles as "Will (Fill in the Blank) Survive the 90s?" and "(Fill in the Blank): Strategy for the 90s," and "The 90s: The (Fill in the Blank) Decade."

If my mail is any indication, 1990 will bring hundreds of these stupefying sessions—not to mention newsletters, articles, press releases, T-shirts, and digital-clock paperweights. But here at the Stephen Manes Column, we believe in saving time and bother for you, the reading public. So we've generously collected all the truly important prognostications here in simple, easy-to-read chronological order. It's our contribution to productivity: scan the information below, and you can safely avoid computer seers until 1999!

1990: EISA and MCA buses are revealed to accelerate erratically without user intervention; government recall is ordered after independent laboratories confirm inexplicable intermittent *Microsoft Windows* speedups. Steve Jobs's "state-of-the-art" PluriBus, designed to accept ISA, EISA, MCA, and NuBus cards, loses support after S-100 developers' boycott and sit-in.

BARRIER BROKEN!

1991: OS/3 arrives; programmers hail breaking of the "onerous, arbitrary, capricious" 16-megabyte barrier. "We're all breathing a sigh of relief," announces a typical applications software vendor. "When you figured in all the system and code overhead, it was impossible to write good applications with the old constraints."

1992: The year of the cable: Wire manufacturing stocks soar as corporations rush to link

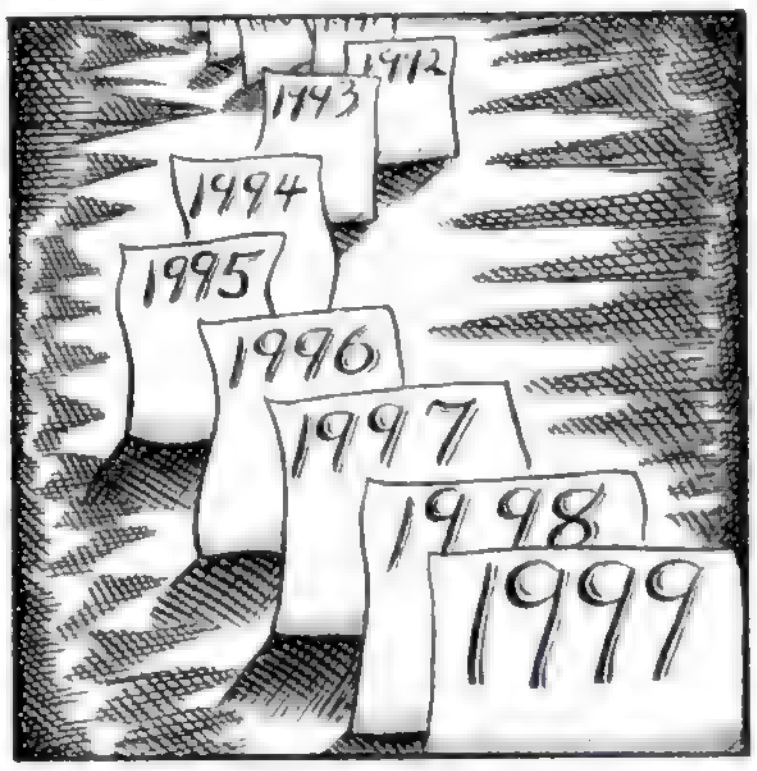

ILLUSTRATION: TOM LULEVITCH

their machines to in-house mainframes and minicomputers in preparation for a flood of SAA "resident-anywhere" software, due "next year or maybe the year after." Also: IBM introduces portable mass-market multimedia machine capable of playing *Rocky III*, the World Series, and *Managing Your Money* simultaneously on a single display from one CD-ROM while computing a spreadsheet in the background. Two-inch screen and key-

Stephen Manes

board, 34-pound weight, $10,000 price hinder mass acceptance.

1993: Millions of 8088, 8086, and 80286 chips suddenly self-destruct at noon on April Fool's Day. Massive investigation reveals insidious synergistic worm lurking partially in DOS and partially in chips' microcode, causing endless internal loop and subsequent death by overheating. "Good riddance to bad rubbish," says one noted columnist. "If a machine can't fly, let it fry!"

1994: Boom times for computer industry: demand far outstrips supply as users attempt to replace dead 8088, 8086, and 80286 machines with later models, and DOS with OS/3 and heaps of memory. Boom times for attorneys handling lawsuits demanding Intel and Microsoft redesign replacement chips and DOS versions to eliminate worms. Sad times for national liquidators, who purchase NeXT machines with state-of-art PluriBus at five cents on the dollar and end up selling the units below cost.

1995: IBM announces first SAA-compatible "all-platform" COBOL compiler; predicts "tidal wave" of applications by turn of century.

1996: Voice-recognition technology finally turns corner, with introduction of first computer from Toyota British Rover. Machine responds to "sit," "stay," "heel," and "speak" in 14 languages, using much-praised Xerox PARC CANINE interface with PupTalk object-oriented programming language.

BARRIER BROKEN!!

1997: OS/4 announced; programmers cheer breaking of gigabyte barrier. "Great news!" claims a typical vendor. "With the old limits, the operating system and the code didn't leave a heck of a lot of room for data. LIM 16.7 and OS/3 extenders were a kludge at best."

1998: Harvard/Stanford/Sloan/Tokyo productivity report conclusively confirms earlier studies showing extensive computer use actually decreases corporate productivity. Computer stocks decline 50 percent in single day. Corporations respond by eliminating from office machines all fonts except Courier 10, all presentation graphics software, and all on-line services providing weather, stock market, or dating information. Honda General Motors head Toshiro "Bill" Sugihara reminds the industry that smuggling of recreational software, including "desktop video," remains a problem; FujitsIBM reintroduction of "classic green" character-based, no-graphics monochrome adapter and card meets with overwhelming success.

1999: Answering corporate demand for "virtues of simplicity," Casio Smith Corona markets high-end typewriters, handheld calculators with wildly successful "contemplative" campaign featuring photos not of product but of beautiful Kobe "Garden of Pet Rocks." Computers gravitate to their natural markets of insurance companies and homes: Yakolt Apple PepsiCo's "fridge navigator" proves popular, and Nintendo CBS NetWare's "The *Real* Dating Game" and "Wheel of Penny Stocks" interactive on-line ISDN shows take America by storm. Computer/video pundits blitz the nation with full-motion video DVI fax holograms hyping conferences with titles such as "(Fill in the Blank): Will it Survive the Naughts?" ■

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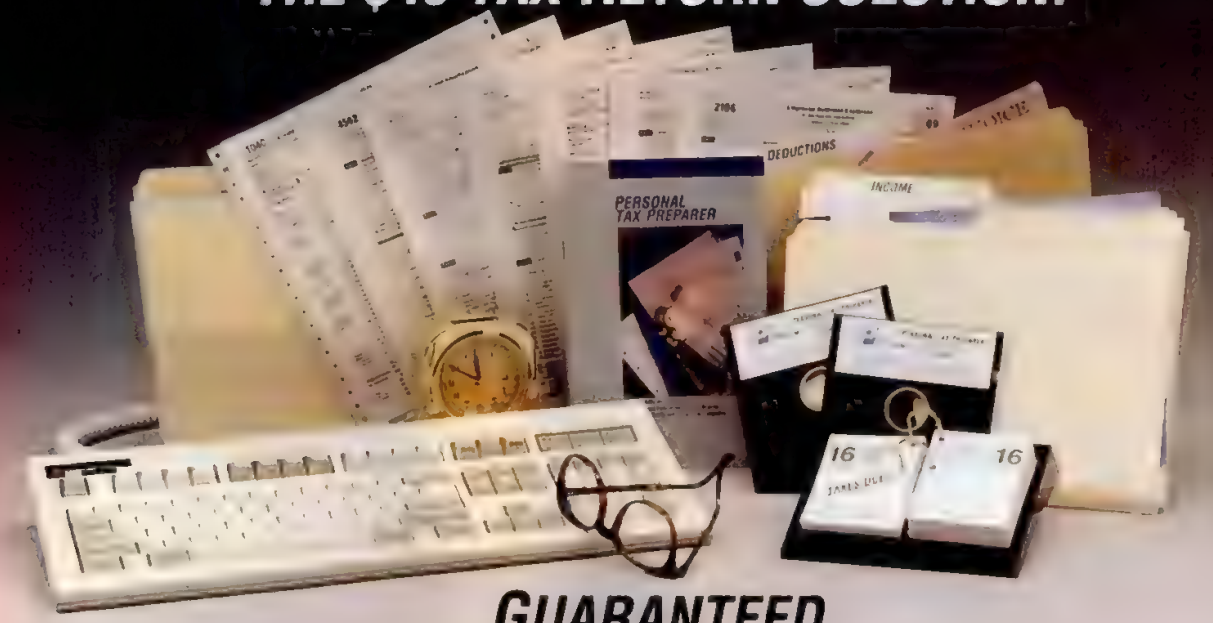

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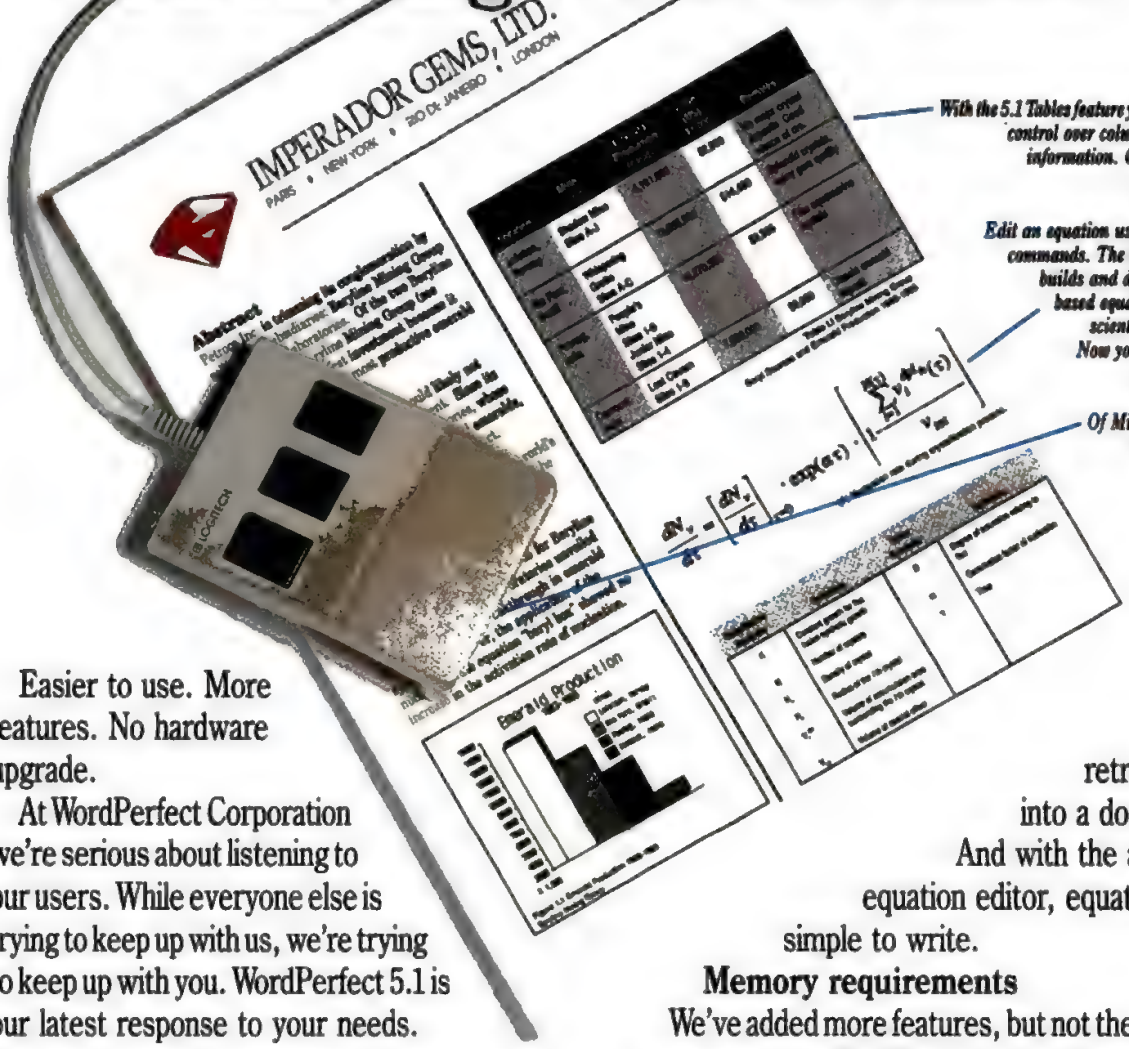

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6th Annual Awards For Technical Excellence

by Bill Machrone

PC Magazine's Awards for Technical Excellence are six years old this year. Like the industry they honor, the Awards are full of confidence, growth spurts, and the occasional wild outburst. This ebullient six-year-old is a bellwether for the industry; this year, all the signs indicate health, growth, and prosperity. They also point to a continuing challenge for our readers, as they must continue to make intelligent choices from the incredible array of available products.

Once again, *PC Magazine*'s editors have sought out the products that advance the state of the art, raise the bar of comparison, and improve the lot of the user. The job gets harder every year as the products get better—and as the distinctions become finer. Some categories, such as desktop computers, are relatively stable at the moment and tend not to exhibit the quantum leaps in technology so obvious in the last several years. The action has moved to portable computers—where designers, marketers, and engineers are trying out a hundred different ideas on an eager public. The challenge is to separate the innovative, fresh idea from clever repackaging and to identify significant steps forward.

On the software side, conventional wisdom has it that everything good has already been invented, that designing software is just a matter of clever coding, adding features, and following the fashions of operating system interfaces. After perusing the past year's offerings, we politely beg to differ. Resurgent interest in utilities and tight, efficient code accompanies the most powerful, comprehensive software products the world has ever seen. And we have the strong sense that the other shoe has yet to fall.

As always, the *PC Magazine* Awards for Technical Excellence honor the designers, engineers, and programmers—the people behind the products. In our deliberations, the commercial success of a product was never a consideration—only its technical merits. To be eligible, candidate products had to ship between October 1988 and October 1989. We presented the awards at Fall Comdex, 1989, in Las Vegas.

Bill Machrone is editor-in-chief and publishing director of PC Magazine.

"And the Award goes to . . . " Straight from the *PC Magazine* Awards for Technical Excellence ceremony in Las Vegas, here are the people behind the most technologically innovative products to ship in 1989.

APPLICATIONS

The battle is won and lost right here. Without application software, there isn't much point to this industry. Some, however, feel that good enough is good enough and that we already have everything we need. The following programs, by their technical excellence, offer a different scenario.

WINNER

Quattro Pro

■ **Charlie Anderson, Dave Anderson, Charles Batterman, Lajos Frank, Perry Gee, Tod Landis, Weikuo Liaw, Rich Reppert, Roger Schlafly, Bob Warfield**
■ **Borland International Inc., 1800 Green Hills Rd., P.O. Box 60001, Scotts Valley, CA 95066; (408) 438-8400**

Seeing *Quattro Pro* in action is believing: this is the top-dog spreadsheet. It offers a range of features that go beyond any competing product while still running on an unadorned 640K XT. *Quattro Pro* clearly advances the state of the art in application software with its combination of performance, feature richness, and compatibility. *Quattro Pro* also proves the value of Borland's VROOMM (Virtual Object-Oriented Memory Management) technology in commercial products.

Quattro Pro

FINALISTS

Crosstalk for Windows

■ **Kent Cedola, Chuck Rudolph**
■ **Digital Communications Associates Inc., Crosstalk Communications Division, 1000 Holcomb Woods Pkwy., #440, Roswell, GA 30076; (404) 998-3998**

It isn't easy being a communications product with a nickname like Wind-X, but *Crosstalk for Windows* overcomes adversity nicely with a powerful and robust script language, background operation, Dynamic Data Exchange (DDE) support, and all the convenience of the *Microsoft Windows* user interface. The scroll bars and dialog boxes add to the ease of use, while terminal emulations such as VIDTEX take full advantage of the graphical environment.

Lotus 1-2-3, Release 2.2

■ **Roy Goodwin, Chris Noble, Eileen Rudden**
■ **Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (617) 557-8500**

Lotus 1-2-3, Release 2.2, has more of what Lotus began in 1983 than ever: tight code that works impeccably. Release 2.2 includes Speedup, Learn, Macro Manager, and *Allways*; it offers improved graphics, network support, and even a limited form of file linking. Release 2.2 may have been long in coming, but it's here and it's what most people need in a spreadsheet.

PerFORM

■ **Bert Amato, Chris Bailey, Scott Northmore, Mark Skapinker**
■ **Delrina Technology Inc., 4454 Genesee St., Buffalo, NY 14225; (800) 268-6082**

PCs have utterly replaced T-squares and ink pens in forms design; and, of course, they excel at forms completion. *PerFORM* leads the pack on both counts and does it beautifully. This *GEM*–based program makes it simple to create detailed, precise forms and then goes to impressive lengths to minimize the chore of data entry.

CONNECTIVITY

When we evolved the slogan "If you're not connected, you're not computing," we weren't just being glib. Computing in a vacuum is irrelevant. Communication of some type is essential, and the workgroup is becoming critically important in fulfilling the potential of individual productivity. Hence the phenomenal growth in connectivity this past year, and PC Magazine*'s intense focus on it.*

WINNER

NetWare 386, Version 3.0

■ **Richard King, Drew Major, Raymond J. Noorda**
■ **Novell Inc., 122 E. 1700 South, Provo, UT 84601; (800) 379-5900**

What can you do for starters with a clean piece of paper and a 32-bit processor when you're in the local area networking operating system business? Quite a lot, as it turns out. *NetWare 386* sets new standards for performance, architecture, sheer power, and flexibility. *NetWare 386* is even 486-aware, the first commercial program to be so. It opens up entire new vistas of server-based applications via NetWare-loadable modules. *NetWare 386* is a tour de force; it bears clear lines of descent from *NetWare 286* while using all the power of today's state-of-the-art processors.

NetWare 386
Version 3.0

FINALISTS

LattisNet Network Management System

■ **Peter Cross, Ron Schmidt, Chang Wang**
■ **SynOptics Communications Inc., 501 East Middlefield Rd., Mountain View, CA 94043-4015; (415) 960-1100**

LattisNet starts with 10-megabit-per-second LAN connections over twisted-pair wiring or fiber-optic cabling, then polishes the system with a sophisticated network management program and dedicated hardware. The Network Management Module collects data about the network and presents it in screens that are simultaneously gee-whiz and genuinely informative. Tools such as this—once the sole province of custom networks—seem futuristic today and will be commonplace tomorrow. The LattisNet Network Management System is a bold leap forward.

XcelleNet

■ **Dennis Crumpler, Shereef Nawar, the XcelleNet Design Team**
■ **XcelleNet Inc., 1800 Century Blvd., #700, Atlanta, GA 30345; (404) 982-9900**

OS/2 and the Presentation Manager are destined for an active future in connectivity. With *XcelleNet*, the future begins now. From a single machine, *XcelleNet* can manage a wide-area network of hundreds, even thousands, of PCs. It manages dial-up communications for PCs in point-of-sale and other configurations where secure, simple operation is required. *Xcellenet* makes mainframes and leased lines obsolete for many applications, bringing PCs into new realms of usefulness.

DEVELOPMENT TOOLS

MultiScope
OS/2 Debugger

Software takes time. Good software takes longer. Without the proper tools, development time could stretch out forever. Developers continue to be the most exacting, demanding audience. This year's crop of products won't disappoint them.

WINNER

MultiScope OS/2 Debugger

■ Conrad Herrmann, Kenneth Kiraly, Mansour Safai, Alain Wegmann
■ Logitech Inc., 6505 Kaiser Dr., Fremont, CA 94555; (415) 795-8500

Codeview may be the standard way to debug OS/2 applications, but Logitech's MultiScope OS/2 Debugger is the right way. This powerful tool belongs in every OS/2 developer's arsenal. The innovative user interface may look like information overload to the uninitiated, but it's sheer joy to the serious programmer. We're used to debuggers that show the executing program on one monitor and the debugging session on another. MultiScope now goes a giant step further by allowing the two sessions to take place on different *computers*.

FINALISTS

Smalltalk/V PM

■ Mike Anderson, Lee Breisacher, Lam Nguyen, Michael Teng, Roger Thayer
■ Digitalk Inc., 9841 Airport Blvd., Los Angeles, CA 90045; (800) 922-8255

The oldest graphical environment meets the newest as Digitalk brings *Smalltalk/V* to the Presentation Manager. *Smalltalk*'s legendary ease of use makes it simple to manage PM objects such as scroll bars, dialog boxes, and pop-up windows. The look and feel is that of the Presentation Manager, but the development environment is pure *Smalltalk/V*. Programmers and users alike will appreciate the ease of integrating existing PM applications with *Smalltalk* applications via Dynamic Data Exchange (DDE).

Turbo Pascal, Version 5.5

■ The Turbo Pascal Team
■ Borland International Inc., 1800 Green Hills Rd., P.O. Box 60001, Scotts Valley, CA 95066; (408) 438-8400

In *PC Magazine*'s first Awards for Technical Excellence presentation six years ago, we credited Borland International with "singlehandedly saving Pascal from oblivion." Over the years, Borland has continued to extend Pascal while remaining true to the original definition and intent. Turbo Pascal takes it into a new dimension: object orientation. Version 5.5 introduces concepts from C++, such as classes and inheritance. It also features sophisticated overlay control with items such as least-recently-used and least-recently-loaded buffer management. This ground-breaking language implementation is one of the easiest to learn while producing professional-quality results.

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ENTERTAINMENT/AFTER HOURS

We all know that the PC at home is there to extend the workday. We work-crazed yuppies wouldn't have it any other way. But sooner or later, the job is done and it's time to kick back. The PC is right there waiting for us with music, games, education, self-improvement, and home management.

WINNER

Roland LAPC-I

■ Alberto Kniepkamp, Frank Rebeka, Glenn Stier
■ Roland Corp. U.S., 7200 Dominion Circle, Los Angeles, CA 90040-3647; (213) 685-5141

From its role in the forefront of electronic music, it's a short hop for Roland to a board optimized for sound on the PC. But it's a giant leap for the PC, which has suffered the indignities of its tinny speaker and primitive driver long enough. Games played through the LAPC-I take on a whole new dimension of enjoyment and excitement. The LAPC is also a building block in making the PC into a complete electronic music machine with breathtaking capabilities.

Roland LAPC-I

FINALISTS

TRACON

■ Robert B. Wesson, Dale Young
■ Wesson International, 1439 Circle Ridge, Austin, TX 78746; (512) 675-7220

The most-talked-about simulation this year wasn't a game—at least not in the usual sense. *TRACON* makes you an air traffic controller in some of the busiest air corridors in the country. The realistic display simulates a radar screen, and the pilots are distressingly human as they misinterpret your directions. This one's good enough to base career decisions on.

Vette!

■ Dan Geisler
■ Spectrum HoloByte, 2061 Challenger Dr., Alameda, CA 94501; (415) 522-3584

Vette! rises to the top of the simulation game ranks with a hair-raising ride through the streets of San Francisco in any of half a dozen Corvettes. The animation, action, and thoughtful details put you in the driver's seat—again and again.

World Class Leader Board

■ Bruce Carver, Roger Carver, Vance Cook, Kevin Homer, Bruce Johnson, Steve Witzel
■ Access Software Inc., 545 W. 500 South, #130, Bountiful, UT 84010; (800) 824-2549

World Class Leader Board is a pretty good golf simulation. What makes it exceptional is RealSound. The folks at Access Software have figured out how to get around the daunting limitations of the PC's speaker port. The result is clear, intelligible speech and sound effects. From the swish and thwack of a well-hit shot to the offhand comments of your golfing partner, the realism and clarity are continually amazing.

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in California

when your brushes are
in Baltimore.

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CIRCLE 731 ON READER SERVICE CARD

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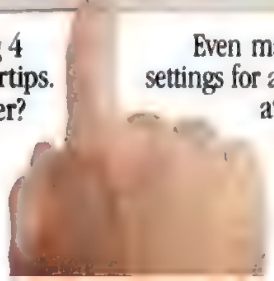
20 features, including 4 macros, right at your fingertips. What could be simpler?

Even macros that recall all the settings for a particular document at the touch of a single key.



True letter quality, high-resolution graphics, and seven resident fonts, so it's ideal for all your office applications. You'll find the 1624's letter-quality mode as fast, or faster, than most popular 9 pins. Up to 63 LQ characters per second. With its 360 x 360 dpi bit-mapped graphics, you can incorporate special printed effects into your documents. Like company logos and line art.

P1-PC

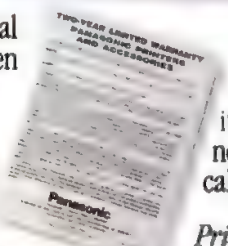
Done.

Multiple paper paths mean you can put this printer exactly where you want it. There aren't many places in an office to conveniently put a printer.

So the 1624 gives you a choice of 4 different paper paths: single sheets from the top, and fanfold from the front, bottom or rear. A special 'Paper Park' feature even lets you feed single sheets from the top, without removing rear-fed fanfold.

Only one paper path is available at any given time for continuous paper.

A 2-year limited warranty in this day and age? That's investment protection, Panasonic-style. You'll find 2-year warranties rather rare in the printer industry. But standard with the Panasonic 1624.



See your dealer for details.

So if you've been waiting for the ideal multi-purpose office printer, it has arrived. For the name of your nearest Panasonic printer dealer, call toll-free 1-800-742-8086.

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CIRCLE 138 ON READER SERVICE CARD

300 fonts
in the palm of your hand.

It's amazing. You would have to buy dozens of cartridges for your HP LaserJet printer to get the fonts that SuperSet delivers in two.

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Others claim to put over 150 fonts on a single cartridge, but their shortcuts can boggle your software drivers and leave you unable to perform simple operations. SuperSet drivers allow you to interface more easily with WordPerfect, PageMaker, MicroSoft Word, and Windows, Wordstar 2000, Lotus 1-2-3, dBase III, Display-Write, MultiMate Advantage II, Ventura Publisher and other popular programs.

Crisp, clean, HP-equivalent font families from Tms Rmn to Helv, presentation graphics to bar codes. Backed by JetWare's reputation for quality and consistency. After all, we're the only company that offers the complete family of HP font cartridges and soft fonts from A to Z. Plus a five-year warranty.

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CIRCLE 159 ON READER SERVICE CARD

GRAPHICS

Graphics continues to be one of the key areas in which the PC can fulfill its promise as a communications tool. The PC has already conquered the worlds of words and numbers. It has already sorted and selected, collated and reported. Graphics has always come last simply because it's much more difficult. The products in this year's nominations make graphics look easy.

WINNER

Autodesk Animator

■ **Robert Bennett, Lewis Gartenberg, David Kalish, Jim Kent, Jack Powell, Gary Yost**
■ **Autodesk Inc., 2320 Marinship Way, Sausalito, CA 94965; (800) 525-2763**

Presentation graphics is being reinvented almost continually. Animation has become an integral part of high-end presentations but has been painstakingly difficult—until now. *Autodesk Animator* gives presentations a previously unimagined dimension of freedom, as well as ease of use. It lets you animate, edit, and produce presentations on your desktop PC and then run them on your VCR. It's spectacular! Never before have presentations been so information-packed or so enjoyable.

Autodesk Animator

FINALISTS

Corel Draw!, Version 1.1

■ **Pat Beirne, Michel Boulion, Mark Charlesworth, Ian Rae**
■ **Corel Systems Corp., 1600 Carling Ave., Ottawa, Ontario, Canada K1Z8R7; (613) 728-8200**

Corel Draw! is a tool for artists. This *Microsoft Windows*–based package achieves that elusive quality sought by all software: transparency. It implements its tools the way artists expect them to be implemented. *Corel Draw!*, with 50 precision fonts and over 43 expandable custom PostScript patterns, is also a spectacular tool for manipulating type. Packed with powerful, flexible drawing tools, it's a professional tool for professionals.

PC Paintbrush IV

■ **Jeffrey Albertine, Neal White III, Mark S. Zachmann**
■ **ZSoft Corp., 450 Franklin Rd., #100, Marietta, GA 30067; (404) 428-0008**

Bitmapped paint programs are alive and well—and continue to advance the state of the art, thanks to *PC Paintbrush IV*. ZSoft's aggressive development has taken this program into outline fonts, 256-color screen display and output, versatile text-handling, special effects, and file exchange with desktop publishing programs.

HARDWARE

The essential nature of the PC is that it's kit-built. No matter how fully configured it comes from the factory, there's always room for more. Add-on products make the PC what it is: an obsolescence-proof investment in the future.

WINNER

Audio Visual Connection

- **Brad Beitel, Jack Deacon, Wayne Galella, Doug Gordon, Chuck Peek**
- **IBM Corp.**

Contact your local authorized IBM dealer.

IBM's Audio Visual Connection is a breakthrough in PC multimedia hardware and software that will likely set the standards in this nascent field. The audio and video adapters are tied together by excellent software that permits a full range of editing and special effects. The on-screen fonts are anti-aliased for maximum resolution. IBM believes in multimedia and sees it as a fundamental shift in how we learn and make presentations. So do we.

Audio Visual Connection

FINALISTS

Giga 1230

- **H. Hammer, H. Hauth, H. Heuer, Harald Sonntag**
- **GigaTrend Inc., 2234 Rutherford Rd., P.O. Box 4298, Carlsbad, CA 92008; (619) 931-9122**

GigaTrend turns digital audio tape (DAT) into a reality for PCs. DAT was destined from day one to make profound effects in areas beyond consumer audio. The diminutive, helically scanned tape, with its 1.2-gigabyte capacity, directory structure, and fast random access is a natural for high-end backup, data storage, and software distribution. Beyond adapting the audio drive to PC needs, GigaTrend delivers a wide range of drivers for popular hardware and software interfaces.

FINALISTS

NEC MultiSync 3D, 4D, and 5D monitors

- **Jerry Benson, Tom Grau, Wayne Hinson, Keith Schaefer**
- **NEC Home Electronics (U.S.A.) Inc., 1255 Michael Dr., Wood Dale, IL 60191; (312) 860-9500**

NEC got out in front first with the MultiSync—and stayed there. The 3D, 4D, and 5D monitors are significant additions to the MultiSync family. They add digital controls and automatic recall of user preferences for each video mode to a product line that's already won the Award for Technical Excellence and numerous Editor's Choices. The 4D monitor takes multiscanning into a new dimension: the 16-inch tube may prove to be the perfect size for high-resolution color work in cramped offices.

DP-Tek LaserPort GrayScale

- **Wayne Bradburn, Allen Frazier, Randy Grobs, Stan Pierson**
- **DP-Tek Inc., 245 N. Hydraulic, Wichita, KS 67214; (316) 269-3068**

Visual Edge

- **Kerry Bott, Mark Christensen, Wynn Smith**
- **Intel Corp., Personal Computer Enhancement Operation, 5200 NE Elam Young Pkwy., Hillsboro, OR 97124-6497; (800) 538-3373**

The once-humble HP LaserJet has been exalted into a number of roles well beyond its intended mission. Intel's Visual Edge and DP-Tek's LaserPort GrayScale add-in boards separate graphics from text and take control of the engine's laser beam to produce newspaper-quality halftones—while accelerating graphics processing in general. This canny technological feat lowers the cost of entry into desktop publishing and improves the results dramatically.

Add These Extras For Nothing Extra.

Introducing Draw Partner,™ a drawing package that adds power and pizzazz to a presentation without costing one cent extra. Designed especially to work with Harvard Graphics™ from Software Publishing Corporation, this new accessory is free with every purchase of Harvard Graphics.

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SPC SOFTWARE PUBLISHING CORPORATION

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OPERATING ENVIRONMENTS

Even though DOS has tens of millions of satisfied users, most of them can think of ways to improve it. Whether they start from DOS or from a clean slate, operating environments remain the most controversial, volatile area of software development.

WINNER

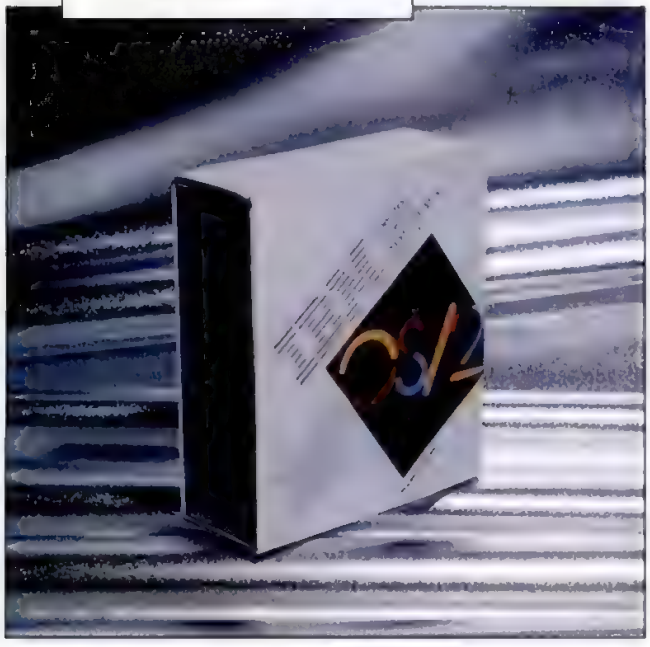
OS/2, Version 1.2

■ The IBM OS/2 Development Team
■ IBM Corp.
Contact your local authorized IBM dealer.

■ Microsoft Corp., 16011 NE 36th Way, Box 97017, Redmond, WA 98073; (800) 426-9400, (206) 882-8080

Bring up OS/2 and you've found the hands-down easiest way to pick a fight in the computer industry. Whatever your point of view, it doesn't matter; there's always someone to oppose it. Our view is that OS/2, while still terra incognita for most programmers, is a joy to write for and will be the foundation of a whole new breed of application programs. The release of Version 1.2 last September brought many significant improvements, like the High-Performance File System (HPFS). With its support for large volumes, long filenames, and extended attributes, HPFS gives breathtaking performance never before available. It lays the groundwork for a true object-oriented file system in the future. And the good stuff doesn't stop at the HPFS. The Presentation Manager—enhanced dramatically by push buttons with a 3-D look, color icons, and an icon-based program starter—synergizes and completes OS/2. New drivers for PostScript, Hewlett-Packard LaserJet, and Epson printers round out the 1.2 package. This is the future; it's nice to know it'll be there waiting for us.

OS/2
Version 1.2



FINALISTS

HP NewWave Environment

■ The HP NewWave Environment Development Team
Hewlett-Packard Co., Personal Software Division, 3410 Central Expressway, Santa Clara, CA 95051; (800) 752-0900

The *HP NewWave Environment* takes *Microsoft Windows* into an entirely different dimension—one defined by objects, icons, and agents. The new terminology spells incredible, almost instinctive, ease of use, plus dramatically shorter software development times and virtually instantaneous multiuser applications. With *NewWave*, object-oriented design principles are brought directly to the user in the relationship between applications and the documents they manipulate. *NewWave* is a vital contribution to the technology pool in *Windows*, and, ultimately, in the Presentation Manager.

The Wang Freestyle System, Version 1.0

■ Alex Harui, Chia Chuan Haino, Stephen R. Levine, Michael W. Schirpke
■ Wang Laboratories Inc., One Industrial Ave., Lowell, MA 01851; (800) 522-9264

It's significant that both of our operating environment finalists are iconic, object-oriented systems. Those of us who use computers so productively and offhandedly in our daily lives are continually frustrated by the attitude of our coworkers who ask, "What do I need a computer for?" Freestyle—a hardware/software system that lies on top of DOS—is a valid answer to those who have consigned themselves to noncomputerdom. With a quick, painless learning curve, Freestyle brings automation to areas of office communications ignored by many computer systems: handwritten notes, telephone messages, and spoken discussions. In addition, Freestyle takes the rest of us to new heights of usefulness with voice annotation, easy access to scanned images, and a host of other innovative features.

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*Egyptian scribes had a real time of it when it came to excessive key strokes. Each letter, or hieroglyph, had to be individually etched into stone. And we complain today about writer's cramp?

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CAERE

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CIRCLE 267 ON READER SERVICE CARD

PORTABLES

With EISA and 486 machines missing the window for this year's Awards for Technical Excellence, there wasn't much notable happening in desktop machines. The innovation, for the moment at least, has passed to portables. A lot is going on in the world of portables, and all of it exciting.

WINNER

The Poqet PC

- **Ian Cullimore, John P. Fairbanks, Leroy Harper, Shinpei Ichikawa, Stav Prodromou**
- **Poqet Computer Corp., 201 San Antonio Circle, C-250, Mountain View, CA 94040; (408) 737-8100**

Last year, we carried the winning NEC UltraLite to the podium in an interoffice envelope. This year, a jacket pocket or handbag will suffice. Size alone doesn't determine the winner: the Poqet PC is a technological tour de force—from power management to miniaturization to screen technology. The Poqet PC is a real MS-DOS computer, with a full screen, in a form factor that we would have called impossible a year ago.

The Poqet PC

FINALISTS

NEC ProSpeedCSX

- **Jay Halloran, Mark Perry, Mike Pritchett**
- **NEC Home Electronics (U.S.A.) Inc., 1414 Massachusetts Ave., Boxborough, MA 01719-9988; (508) 264-8000**

Behind the scenes, the major laptop vendors have been engaged in a pitched battle to take the lead with a commercial color LCD screen. NEC got there first with a handsome, readable color display in a powerful, 386SX-powered package. The ProSpeedCSX brings together an impressive array of new technology, from the obvious innovation in the screen to subtler improvements such as power consumption and heat dissipation.

GRiDPad

- **The GRiDPad Development Team**
- **GRiD Systems Corp., 47211 Lakeview Blvd., Fremont, CA 94538; (415) 656-4700**

Handwritten character recognition is science fiction come true. And the GRiDPad is the first commercial adaptation. At an affordable price, this slim, notebook-size machine readily reads block-printed capital letters and numerals written with an "electronic pen." It runs up to 8 hours on batteries; supports MS-DOS, which puts it into the mainstream of computer usage; and opens up new vistas to people for whom a keyboard is impractical.

Until now, power protection was either too little.

Or too much.

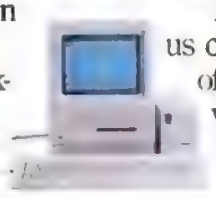
Introducing
The first UPS prote

Actual size.

Now for just about the price of a decent surge supressor, you can have complete Emerson UPS protection.

Reliable protection from surges, spikes, sags, brownouts, even complete power outages. Protection that can save you hours of staff time, mountains of data and pay for itself in a flash.

This little 3″ x 5″ package will support most entry-level PCs. Slightly larger sizes protect LANs, file servers and engineering workstations.



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Emerson technology let us cut the size, the number of parts, and price—but we didn't cut corners. In fact, Accupower's advanced VLSI circuit design actually improves reliability.

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Actual price.

Automatic overload protection is built right in. Output is optimized to match your PC power supply. And there are plenty of receptacles to help protect your peripherals, too.

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EMERSON UPS

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For every computer in the office.

Model 10 *Model 20* *Model 40* *Model 50* *Model 30*

Now there's a complete UPS designed to fit on every desktop. And into every budget. In fact, at these prices, you really can't afford to be without one:

Model 10, designed for entry level computers like the PS/2 Model 30 or similar systems.

Model 20, for small business systems, including multiple Macintosh SE/30 computers, PS/2 Model 50 and similar network nodes.

Model 30, for typical business systems, including Compaq 386/16 Deskpro and similar PC compatibles.

Model 40, for sophisticated systems or small networks, such as an AST 286 with two Bravo workstations.

Model 50, for large networks or major systems, such as the Sun 3/60, the PS/2 Model 60 and comparable workstations.

Best of all, Accupower comes from Emerson UPS. The world UPS leader for more than 25 years. With a solid, reliable product line already protecting thousands of computers, PCs to mainframes, world-wide. And direct local service near you.

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PRINTERS

If it weren't for printers, there probably wouldn't be a personal computer industry. It all comes down to output, the ability to convey your ideas to others. Technology and engineering have been unrelenting; daisy wheel printers have yielded to dot matrix and now dot matrix to laser. Not only has quality increased but cost has plummeted, spawning entire new markets such as desktop publishing.

WINNER

IBM LaserPrinter

■ William R. Bowles, William I. Branson, Paul J. Curlander
■ IBM Corp.
Contact your local authorized IBM dealer.

The IBM LaserPrinter hits new heights of compatibility, size, and value engineering. It packs enormous power and flexibility into a diminutive package. As ever, IBM thinks of its installed base first, and the LaserPrinter carries an impressive number of emulations internally, from the IBM Graphics Printer and the IBM Proprinter to the Hewlett-Packard LaserJet II and HPGL. It does everything just a little bit better than the competition: it holds a little more paper, prints a little faster, runs a little more quietly, takes up a little less space—all while using about a third of the parts of comparable printers. That spells reliability. And technical excellence.

IBM LaserPrinter

FINALISTS

Hewlett-Packard LaserJet Series IIP

■ The HP LaserJet IIP Design Team, Boise Printer Division
■ Hewlett-Packard Co., 19319 Pruneridge Ave., Cupertino, CA 95014; (800) 752-0900

Hewlett-Packard just about invented the laser printer market. With the LaserJet Series IIP, HP reinvents the low end of the market. Armed with the IIP's $1,000 street price, a new entry-level speed of four pages per minute, and full LaserJet II compatibility, HP continues its relentless push to make any other kind of printer an also-ran.

QMS ColorScript 100 Model 10

■ Rick Armstrong, Doug Canida, Scott Hassell, Hossein M. Kalantar, Marie A. Prosser
■ QMS Corp., One Magnum Pass, Mobile, AL 36618; (800) 631-2692, ext. 902

Color PostScript finally broke the $10,000 barrier, and it took the QMS ColorScript 100 Model 10 to do it. This innovative machine doesn't give up anything to its more-expensive competitors. And it offers everything its more expensive sibling, the Model 30, does except B-size paper and a high-volume duty cycle. The Model 10 is built around the all-new Mitsubishi G370 engine, a model of efficiency and purposeful design.

Varityper VT600P

■ The VT600P Product Marketing and Technical Group
■ Varityper Inc., 11 Mt. Pleasant Ave., East Hanover, NJ 07936; (800) 631-8134, (201) 887-8000

600- by 600-dot-per-inch resolution on a printer isn't new—just spectacular. We first looked at the Varityper VT600 two years ago, but the technological improvements in the VT600P are impressive. A new engine that can handle smaller-particle toner makes this printer an affordable low-end typesetter. The Apple LaserWriter PostScript emulation makes the VT600P a cinch to use with PCs instead of a near-impossibility.

UTILITIES

Think of utility software as a means to an end, not an end in itself. You will soon find, however, that utility products are every bit as indispensable as the applications they serve.

WINNER
Magellan

■ Steve Colwell, Bill Gross, Larry Gross, Lee Hasiuk, Barry Megdal, Beverly Robertson, Dave Rolfe
■ Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (617) 577-8500

Great software makes it look easy. *Magellan* makes it downright simple. After breaking ground with a clever and highly efficient indexing scheme, *Magellan* implements "fuzzy" searches, so users don't have to remember the exact contents of a file in order to find it. Users will appreciate *Magellan*'s viewers for all the popular applications, which save them from having to launch an application to look at a file. They'll also appreciate *Magellan*'s ability to launch an application when they decide they need it. *Magellan* makes the term "user friendly" believable all over again.

OmniPage

■ William W. Allen, James Chen, Tong Chen, Vijayakumar Rangarajan
■ Caere Corp., 100 Cooper Ct., Los Gatos, CA 95030; (408) 395-7000

OmniPage is a breathtaking achievement in optical character recognition (OCR). It can even master difficult formats such as multicolumn forms and mixed type styles and sizes, as found in magazines. It uses a dedicated coprocessor board, but it's the software that makes the magic. The *Microsoft Windows*–based display is fascinating to watch as *OmniPage* decides how to segment a scanned page for reading. The accuracy and ease of use brought by *OmniPage* brings OCR out of the realm of wishful thinking and into daily business use.

FINALISTS
4DOS

■ Rex Conn, Tom Rawson
■ JP Software, P.O Box 1470, East Arlington, MA 02174; (617) 646-3975

4DOS is a shareware replacement for COMMAND.COM, and we can all hope that Microsoft downloads a copy from PC MagNet or virtually any bulletin board and uses it as a guide for improving DOS. This little dynamo keeps the tried-and-true DOS prompt, but adds a world of power and flexibility to nearly every command.

The Norton Commander, Version 3.0

■ Linda Dudinyak, Keith Ermel, John Socha
■ Peter Norton Computing Inc., 100 Wilshire Blvd., Santa Monica, CA 90401-1104; (213) 319-2000

The latest release of *The Norton Commander* carries an impressive array of enhancements, making it virtually a new product. In addition to the usual commendable features, such as point-and-shoot and getting out of the way of the command line, it offers file viewers and even an electronic-mail handler. In the field of DOS shells, the first challenge is for the cure to be better than the illness. *Commander* thankfully takes DOS to a whole new level of well-being.

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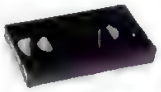
With Willow's VGA-TV.™

Now you can connect your PC and TV and see your favorite software programs on the big screen. Only VGA-TV gives you both a Super-VGA card and the proven video connection exciting these industry experts:



***"Product of the Week:* VGA-TV...a very useful product...that gives users the option of showing their VGA presentations on a regular TV or taping VGA presentations using a VCR."**

John Dvorak

"Until recently you were out of luck if you wanted to see your PC programs on video. Willow Peripherals now offers the VGA-TV card...that puts out a broadcast-quality NTSC RS170 composite video signal."

PC Magazine

"The card's price, its range of display modes, and its video capability make it quite a bargain."

Compute!

"...VGA-TV will provide an important link to the NTSC world."

MicroCad News

VGA-TV is a 100% register and BIOS compatible VGA card that outputs a broadcast quality NTSC composite (or RGB) signal to a TV through an RCA jack on the board. Fully compatible with previous graphics standards, VGA-TV is priced at only $699, and fully backed by Willow's 3-year warranty and toll-free technical support.

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Phone: (212) 402-0010 or
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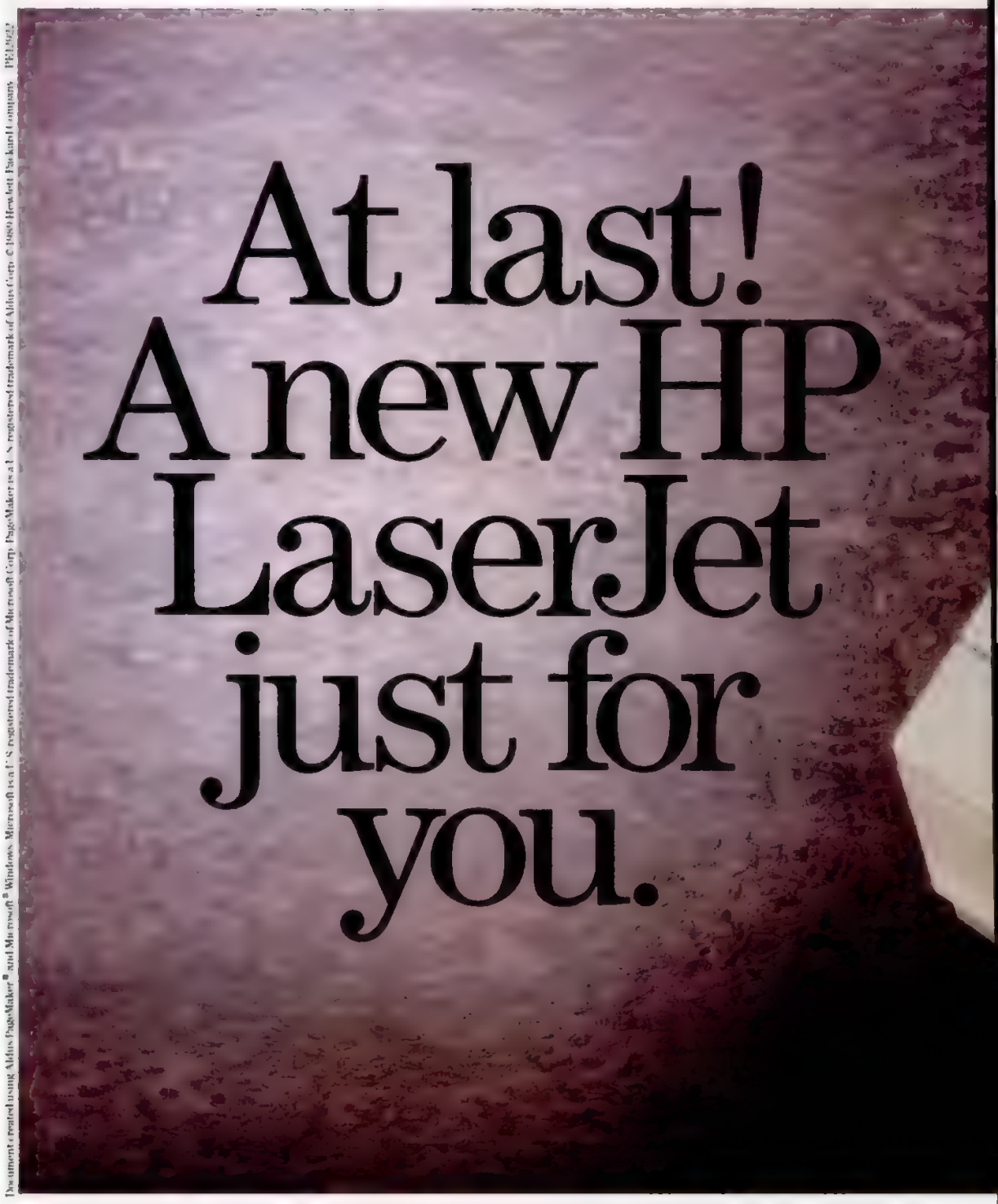
CIRCLE 293 ON READER SERVICE CARD



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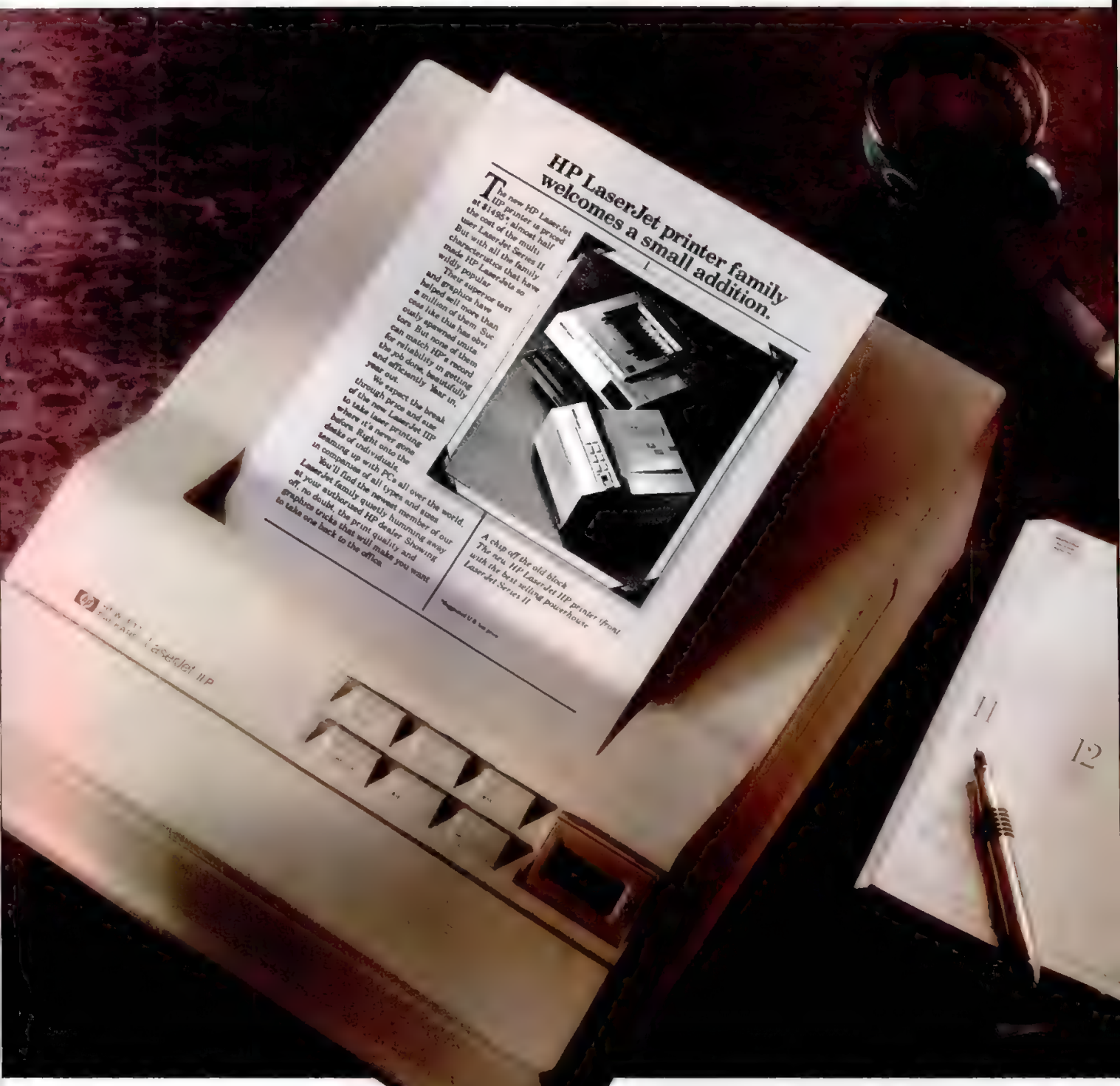
At only $1495*, it's got your name on it.

The HP LaserJet printer family has expanded—in a small way.

The new HP LaserJet IIP (as in Personal) fits right on your desk. And, with a price almost **half of the multi-user LaserJet Series II,*** into most budgets.

Its simple front panel gives you easy, push-button control over the menu, the 14 internal fonts, form feed and other functions. It handles four different paper sizes: letter, legal, executive and A4, as **well as envelopes. In portrait**

*Suggested U.S. list prices: LaserJet IIP $1495; LaserJet Series II $2695. Dealer prices vary.



The new HP LaserJet IIP printer.

or landscape configurations. At four pages a minute. From one or two paper bins (the second is optional).

The 512K standard memory is upgradable to 4.5 Mbytes for more complex graphics and publishing programs.

And, of course, our new printer is compatible with the HP LaserJet Series II and virtually all popular PC software.

So call **1-800-752-0900, Ext. 277J** for your nearest authorized HP dealer. Then introduce people at your company to their very own HP LaserJets.

There is a better way.

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CIRCLE 305 ON READER SERVICE CARD

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Fortunately LAWN,™ the Local Area Wireless Network, is different.

You see, unlike other networks, it's wireless. That's because it works on advanced radio technology.

So it's not only easy to link your computers, printers, modems and other peripherals. It's also easy to unlink them. Which means you can move and expand them without any bother at all.

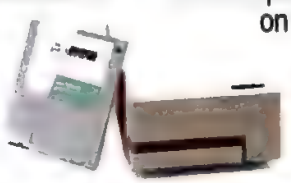
Everything you need comes in one box. Open it and you just plug the LAWN's cable into the back of your computer and load the software into the front of it.

Then simply read the on-screen commands from our software and in minutes you'll be using LAWN for electronic mail, peripheral sharing and file transfers.

It works with just about anything you've already got. PCs. Laptops. Modems. And printers.

So call OCI,™ the originator of this wireless network, at 1-800-OCI-LAWN (624-5296) or a computer dealer near you for information on how you can get a LAWN.

Odds are, it'll make assembling even the simplest kid's toys seem difficult.



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CIRCLE 374 ON READER SERVICE CARD

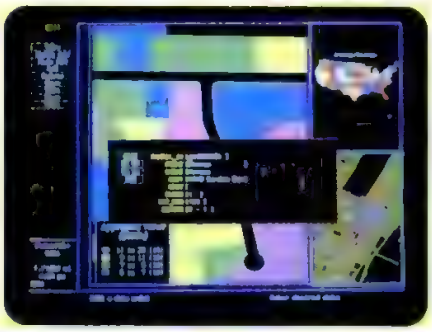
AWARDS FOR TECHNICAL EXCELLENCE: PREVIOUS WINNERS

Year	Product	Company	Category
1988	All Chargecard	All Computers	Add-in Boards
	ALR FlexCache 25386	Advanced Logic Research Inc.	Desktop Machines
	Intel 80386 Design Team	Intel Corp.	Persons of the Year
	Lahey FORTRAN 286 and 386	Lahey Computer Systems Inc.	Compilers/Languages
	Micrografx Designer	Micrografx Inc.	Graphics Software
	Microsoft Mouse	Microsoft Corp.	Design
	Kurta IS/1 Cordless Stylus/Puck	Kurta Corp.	Hardware
	NEC UltraLite	NEC Home Electronics (U.S.A.) Inc.	Portables
	Q&A 3.0	Symantec Corp.	Application Software
	Dennis Ritchie	AT&T Bell Laboratories	Lifetime Achievement
	SunRiver Workstation	SunRiver Corp.	Connectivity
	Turbo Debugger	Borland International	Development Tools
	VM/386	Intelligent Graphics	386 Software
1987	*AutoShade*	Autodesk Inc.	Graphics Software
	Compaq Deskpro 386/20	Compaq Computer Corp.	Desktop Computers
	Compaq Portable 386	Compaq Computer Corp.	Portable Computers
	Douglas Englebart	McDonnell Douglas Information Systems Group	Lifetime Achievement
	LIM expanded memory specification 4.0	Lotus Development Corp., Intel Corp., Microsoft Corp.	Utilities
	Lucid 3D	Personal Computer Support Group	Application Software
	Micro Channel architecture	IBM Corp.	Special Award
	Microsoft Excel for Windows	Microsoft Corp.	Application Software
	Publisher's Type Foundry	Z-Soft Corp.	Desktop Publishing
	QuickBASIC 4.0	Microsoft Corp.	Development Tools
	3Com 10Mb Twisted Pair	3Com Corp.	Connectivity
	Turbo Pascal 4.0	Borland International	Development Tools
	Microsoft Windows/386	Microsoft Corp.	Operating Environments
	Zenith Perfect Monitor, Model ZCM-1490	Zenith Data Systems	Hardware
1986	*Advanced Netware/286*	Novell Inc.	Networking
	Compaq Deskpro 386	Compaq Computer Corp.	Desktop Computers
	Bill Gates	Microsoft Corp.	Special Award
	HAL	Lotus Development Corp.	Software Add-ons
	NEC MultiSync monitor	NEC Home Electronics Inc.	Graphics Hardware
	NewViews	Q.W. Page Associates Inc.	Application Software
	Perspective	Three D Graphics	Graphics Software
	QuickBASIC 2	Microsoft Corp.	Programming Languages
	TIPS	Island Graphics Corp.	Graphics Software
	Toshiba T3100	Toshiba America Inc.	Portable Computers
	What's Best	General Optimization Inc.	Software Add-ons
	Windows, Version 1.03	Microsoft Corp.	Environments
	Zenith Z-181 Portable PC	Zenith Data Systems	Portable Computers
1985	Apple LaserWriter	Apple Computer Inc.	N/A
	Mike Brown	Central Point Software	Special Award
	EGA CHIPSet	Chips and Technologies	N/A
	Freelance	Lotus Development Corp.	N/A
	Plus Hardcard	Plus Development Corp.	N/A
	Javelin	Javelin Software Corp.	N/A
	LANLink	The Software Link Inc.	N/A
	IBM Proprinter	IBM Corp.	N/A
	Trailblazer modem	Telebit Corp.	N/A
1984	*Enable*	The Software Group	N/A
	Framework	Ashton-Tate	N/A
	Infoscope	Microstuf	N/A
	Intel 80286	Intel Corp.	N/A
	PC Blue Series	(Public Domain)	N/A
	Turbo Pascal	Borland International	N/A

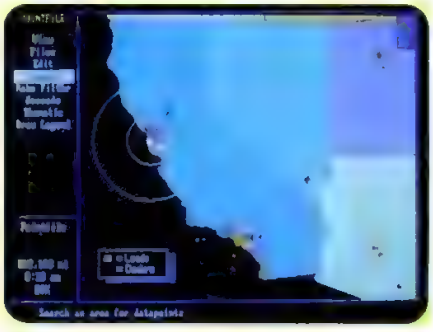
N/A—Not Applicable: Winners were not designated by category in 1984 and 1985.

See Your Data

MapInfo software can find, display and analyze your data geographically. See your prospects, customers, facilities —anything in your database. Find addresses by street, ZIP code, city, etc. (We can even supply the maps.)



Any point or region on the map can have a complete record of data behind it. See your *actual* dBASE data in a window to view, edit, and print. Draw your own boundaries. Add titles and legends for high quality presentations.



Perform analyses on your data to sum, average, or count your database records by location. Color sales territories by volume of orders, ZIP codes by numbers of leads, countries by your demographic data.

From street-level to worldwide, MapInfo can merge your databases with maps. Play visual "what if" with your data. See patterns, trends, and opportunities you never knew existed. If you need to map your data, MapInfo can do it for as little as $750.

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CIRCLE 291 ON READER SERVICE CARD

LIFETIME ACHIEVEMENT

John Warnock
ADOBE SYSTEMS INC.

John Warnock knew what he wanted a long time ago: high-resolution control over output devices. From his CAD work at Evans and Sutherland to his projects at Xerox PARC to Adobe, he's worked steadily toward one goal: PostScript. Aside from all the controversy about font technology, PostScript goes far beyond—to a full-blown page description language. PostScript has given new meaning to the term "device independence" and has fulfilled the laser printer's potential in ways that its inventors never planned. PostScript has taken the mystique out of typesetting while creating a whole new skill set for designers and graphics artists. We commend Warnock for his lifelong vision and the standards he has set.

John Warnock
Lifetime Achievement

PERSON OF THE YEAR

Joseph R. Canion
COMPAQ CORP.

Rod Canion exercises a quiet leadership in this industry. In 1989, he and Compaq have flouted conventional wisdom and disproved the experts as Compaq continues to lead the industry in technology, profits, and a full range of award-winning products. Canion proves that nice guys can finish first while driving challenging initiatives such as EISA. ■

Joseph R. Canion
Person of the Year

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Speed	8 MHz	10 MHz	12 MHz	12 MHz
Wait State	0	1	0	1
Std Memory	640 KB	512 KB	1 MB	1 MB
On-Board Video	MCGA	VGA	VGA	VGA
Monitor	OPTION	OPTION	OPTION	OPTION
Fixed Disk	OPTION	OPTION	OPTION	OPTION
Floppy	720 KB	1.44 MB	1.44 MB	1.44 MB
Serial/Parallel Ports	1S+1P +1M	1S+1P +1M	2S+1P	1S+1P
Price	$1695	$1995	$1495	$2699

Note: Information on this chart is based on published materials.

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CIRCLE 207 ON READER SERVICE CARD

The Best Of

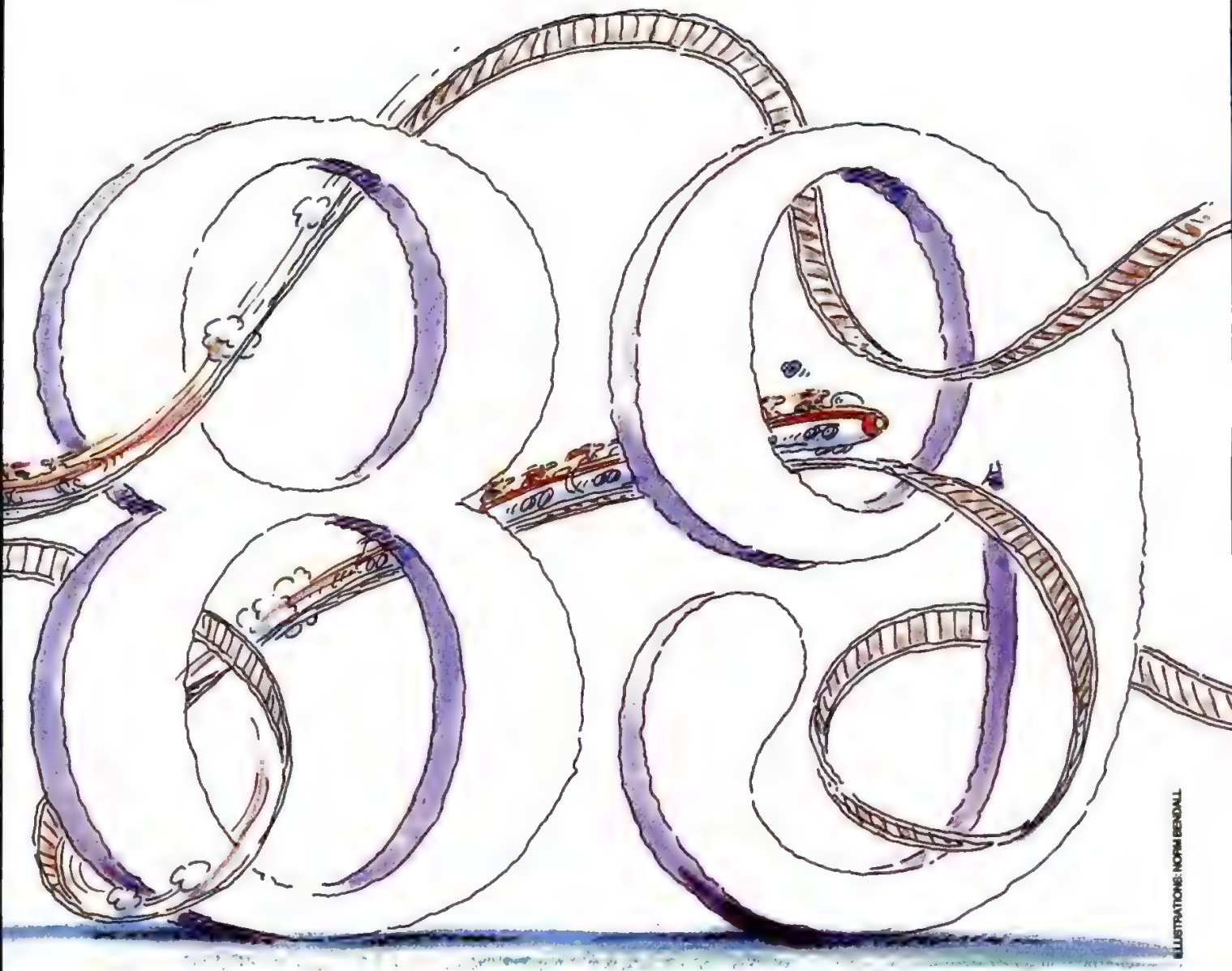
by Bill Howard

In 1989 the world's wackiest roller coaster ride didn't belong to Six Flags Over America, Cedar Point, or Disney World. Rather, it was the gut-wrenching journey shared by nearly everyone who had a stake in the personal computer industry as a user, vendor, or observer. And as befits a roller coaster ride, the year just ended left the bulk of the passengers slightly dazed, generally unharmed, and eager for another trip.

While the business press rewarmed those "Analysts Fear Recession Looms in Computer Industry" stories, the bulk of PC users in large and small businesses plunged ahead with life as usual. They've learned that uncertainty and constant change—"hyperchange," if you're one for buzzwords—are the norm, and if you wait for the industry to settle down before deciding which PC and which word processor to buy, your business quickly becomes a technological laggard.

Consider the changes and uncertainties of 1989:

■ **OS/2's hazy outlook.** Yes, it's going to win out—probably certainly, or is it certainly probably?—but that's still a couple of years off. Best guess as to when OS/2 gets real? 1992 or 1993. But it's important for software vendors to have their apps ready in 1990 if OS/2 is to succeed in 1992. Here's the timetable: A critical mass of OS/2 apps arrives in 1990. Brand-specifying users evaluate them in 1991—and requisition them for delivery and installation on end users' PCs in 1992.



ILLUSTRATIONS: NORM BENDTSEN

■ ***Windows'* bright outlook.** When the new version of *Microsoft Windows* ships (late, as usual), it will perform OS/2-like tricks with memory and multiple applications, and it may approach the Mac in ease-of-use. Which begs the question: If *Windows* 3.0 is so good, what do I need OS/2 for? (See "1989: The Year in Operating Systems" in this issue.)

■ **Vaporware.** Virtually every major piece of software continues to ship behind schedule. To the industry truism that software lags behind hardware, you can add this corollary: applications software lags further still, crippled by late or incomplete delivery of OS/2 and *Windows* environments and developer toolkits. DOS apps lag because of the difficulty of cramming more functionality

Hyperchange dominated the PC industry last year. As users and vendors coped with uncertainty and constant change, the year of the LAN finally emerged. And PCs got faster and faster.

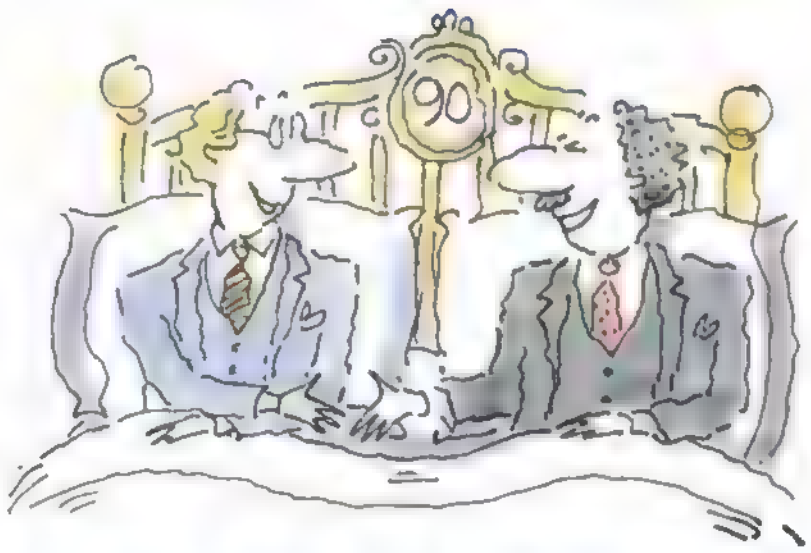
into the increasingly limited 640K workspace.

■ **Hard times of LATE.** Most of the software industry's top five were battered by late deliveries, bugs, fiscal setbacks, corporate head-rolling, and dimmed product appeal: Lotus, Ashton-Tate, and—to a lesser extent—Borland and Microsoft. Wags suggest that a merger of Lotus and Ashton-Tate would produce the stock ticker symbol LATE.

■ **Micro Channel and EISA uncertainty.** When they cut through the hot air, users now realize that Micro Channel and EISA machines hold little if any performance advantage over classic-bus PCs, at least for now, with the likely exception of future file-server applications. (See "1989: The Wait-and-See Year of PCs.")

■ **386s slowly gain momentum.** 286-based PCs account for more than half of all computer sales, essentially defying the advice of just about every forward-looking voice in the industry that says 286s are brain-dead and there's no defensible reason to buy anything less than a 386SX. 386s may finally gain significant market-share momentum in 1990 as savvy corporations realize that the cost of a 386 CPU over a 286 is truly incremental. Figure on 386 PCs taking a third of all sales in 1990, with 8088/86 PCs down to about 10 percent.

■ **Who's aligned with whom?** Perhaps most uncertain of all was the can't-tell-the-players-without-a-scorecard rash of alliances, couplings, and uncouplings. It's enough to suggest the need for a Silicon Valley remake of *Bob and Carol and Ted and Alice*. The oddest couple was Microsoft and Apple, who at year's end stopped slinging mud and look-and-feel lawsuits long enough to turn on Adobe and its proprietary font scheme after Adobe (in the opinion of Apple/Microsoft) got too big for its britches. In 1989 politics made for strange bedfellows. In 1990 bedfellows will make for strange politics.



In 1990, bedfellows will make for strange politics.

THE YEAR OF THE LAN—FINALLY

If you were looking for good news in 1989, you found plenty of it in the connectivity marketplace. LAN boosters grew tired of proclaiming "This will be the year of the LAN" for the umpteenth year, went off to sulk, and watched from the sidelines as connected environments began to reach critical mass—finally. Three-quarters of *PC Magazine* readers say their companies are now using LANs, according to a PC MagNet survey. LAN operating systems have become more powerful and reliable, and they're being tended to by increasingly knowledgeable LAN gurus. Other factors: the decreasing price of network cards and the increasing capabilities of twisted-pair wiring. If you're installing a LAN today, odds are you'll be using twisted-pair (essentially high-class phone wire, already in the walls of most recent buildings). If you see coaxial cable going into an office today, it's likely that someone ordered cable TV, not LAN cabling.

Novell, which has more than half the LAN market now, shipped its powerful *NetWare 386* in September with a truly big-time price ($8,000 plus), and 3Com followed suit a few weeks later with an upgraded version of its OS/2 *LAN Manager* (*3+ Open Lan Manager*, Version 1.1), which—with a specially tuned 3Com file server—came within about 5 percent of matching Novell's performance. Traditionally, *LAN Manager* in every flavor has been a poor second to *NetWare* in performance.

If LANs are to replace minicomputers, users need grown-up software and file servers. 1989 saw the introduction of gigabyte file-storage capacity and the growth of the database server. In a network with a database server, the server front end on the PC passes a short, simple SQL query to a database engine sitting on a file server, and the file server passes back the answer—thus saving the overhead of sending entire database files. The specialized-server concept applies to communications servers (directing modem and fax pools, inter-LAN communications, and mainframe links), printer servers, and even applications servers. Sybase emerged as the brightest light of the database-server companies, forming alliances with Microsoft, Ashton-Tate, Lotus, Sun, and Digital.

Workgroup-productivity and mail software continues to get better—*Higgins*, *Right Hand Man*, *Da Vinci eMail*, and *cc:Mail*, for instance—but you're still hard-pressed to find an electronic group calendar that's as capable and flexible as a good secretary. With its OfficeVision announcement, IBM offered its wide-ranging vision of the connected workgroup environment of the early 1990s. IBM's principal SAA (Systems Application Architecture) offering to date, OfficeVision will be powerful, graphical, and, of course, complete with ties to IBM mainframes and minis. On PCs, it will require the IBM-only Extended Edition version of the Presentation Manager.

While 386s and soon 486s provide blazing speed, your next file server may be a dedicated machine that isn't quite a PC. Most promising are the NetFrame file servers based on multiple 386s with a mainframe-like architecture and a claimed throughput 5 to 15 times that of a fast 386.

ISDN SPELLS OPPORTUNITY

ISDN, the acronym people love to hate (Integrated Services Digital Network or "I Still Don't Need"—take your pick), became real for PCs in 1989, unnoticed except by its well-financed backers. ISDN turns an ordinary telephone line in an office or home into two 64-kilobit-per-second voice or data lines and a third, slower control line, allowing nearly-LAN-speed data transfers across town and eventually across the country. NCR delivered a PC ISDN adapter with OS/2 PM controlling software, and

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For the features section of this issue, the associate editor was Mary Kathleen Flynn, and the PC Labs project leader was Abe Rosner.

AT&T rolled adapters out to VARs. Several smaller companies see ISDN as the next golden path to riches, perhaps justifying the acronym's third definition: "I Smell Dollars Now."

If there's one thing to remember about the LAN market in 1990, it's this: For all the heat generated by the *NetWare 386* vs. *3+ Open LAN Manager* contest, if you're a Novell shop now, you're likely to remain that way and upgrade eventually to *NetWare 386*. If you're a *3+ Share* user now, you're likely to stay within the 3Com family when you upgrade. (If you live with IBM or DEC now, they too have capable solutions designed to keep you in the fold.) Switching LAN operating systems involves far more grief than trading your department-standard Deskpros in for Micro Channel PCs. So, much of the battle is for departments not yet connected, or for offices starting from scratch.

EASE OF USE

For every user who wants more power, there's another who'd rather see PCs that are easier to use. Microsoft chairman Bill Gates envisions CD-ROM-equipped PCs in the early 1990s that provide full-motion, interactive on-screen video and audio training. In the shorter term, the prognosis is for Band-Aid solutions: still more DOS shells and menuing systems to insulate less-skilled users from DOS's quirks, slightly better context-sensitive help in programs, and a brisk market in training tapes and books. *Microsoft Windows* 3.0, when it ships early this year, may turn out to be the best of the DOS insulators, and Microsoft would dearly love to see future PCs shipped with DOS and *Windows* on every machine.

Windows on every DOS machine would also mean having the same interface on PCs running DOS and the Presentation Manager, as well as on Unix workstations, where the PM-like OSF/Motif has gained the upper hand among graphical interfaces. If you listen to the optimists, the new *Windows*/PM interface will be as easy to use as the Mac. We'll see. Or as Apple would say, "We'll see you in court."

Tandy continues to push hard with *DeskMate*, a graphical interface for all PCs (including lower-powered systems that *Windows* would overwhelm). Tandy launched *DeskMate* in part because it got burned by Microsoft when the *Windows* revolution didn't start on schedule (discombobulating plans that had Tandy building *Windows*-specific PCs). Over the summer, Tandy got Lotus and Symantec to develop *DeskMate* versions of *Lotus 1-2-3* and *Q&A Write*. Nonetheless, earlier *DeskMate* champions (Software Publishing and Intuit, for example) have been dragging their heels on *DeskMate*-compatible upgrades.

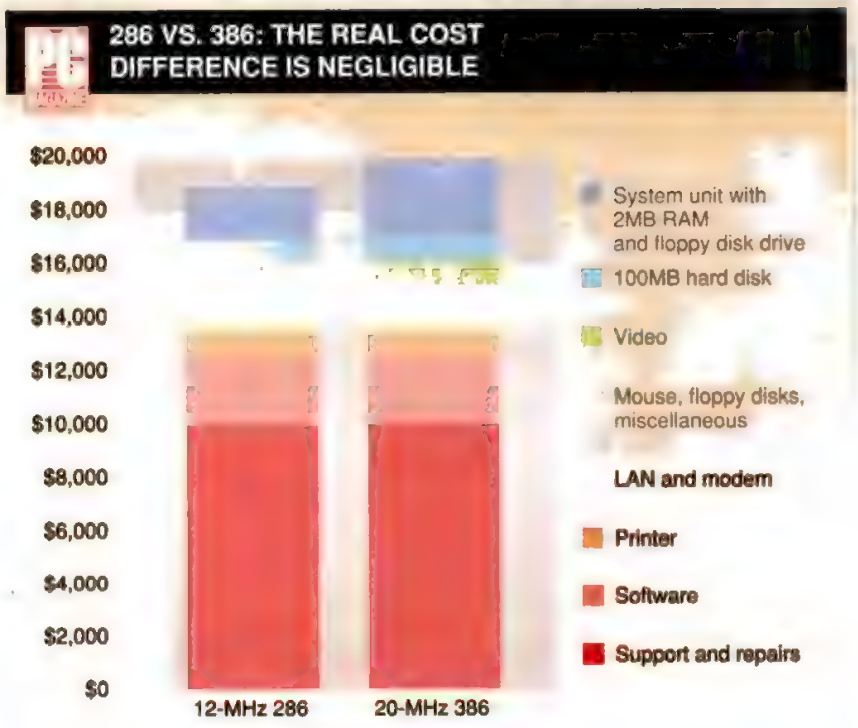
386 POWER: Less than a Dollar a Day

by Bill Howard

The single most important theme that emerged in 1989 is that there's no justification for buying anything less than a 386SX. Anything less is a false economy. Owning a 386 costs you less than a dollar a day more than owning a one-foot-in-the-grave 286. The true cost of a PC is the amount you spend to buy, support, repair, and upgrade one over its likely five-year life span—somewhere around $20,000. (It takes five years to amortize a PC; by that time, it's become obsolete and has probably developed reliability problems.)

The accompanying chart breaks out the cost of ownership for a 12-MHz 286 and a 20-MHz 386 over five years. The single biggest cost is support and service: about $2,000 a year, including indirect costs like a LAN administrator. Only one cost differs between the two instances: the system unit itself.

In 1990, *PC Magazine* will continue occasionally reviewing 286-based PCs. We don't think you should buy one, but in case you've got your heart set on it, we'll tell you which 286 machines provide more bang for the buck than others. But the Editor's Choice box will always read: Buy a 386SX. ■



Over the five-year life span of a PC, the cost of ownership for a 12-MHz 286 and for a 20-MHz 386 is basically the same—approximately $20,000. The only cost that differs is that of the system unit.

Thank You!

We would like to thank the thousands of clients who purchased Gateway 2000 computer systems in 1989. Without you, we would be nowhere! You have helped us become a leading personal computer manufacturer, and we are grateful.

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You will be hearing much about us as we cement our position as the leading direct marketer of microcomputer systems. We look forward to working with you in the 1990s and for many decades to come.

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Ted Waitt
President

Norm Waitt
Vice President

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Service

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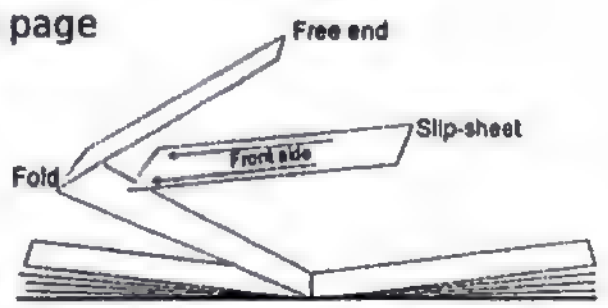

Inverted Back

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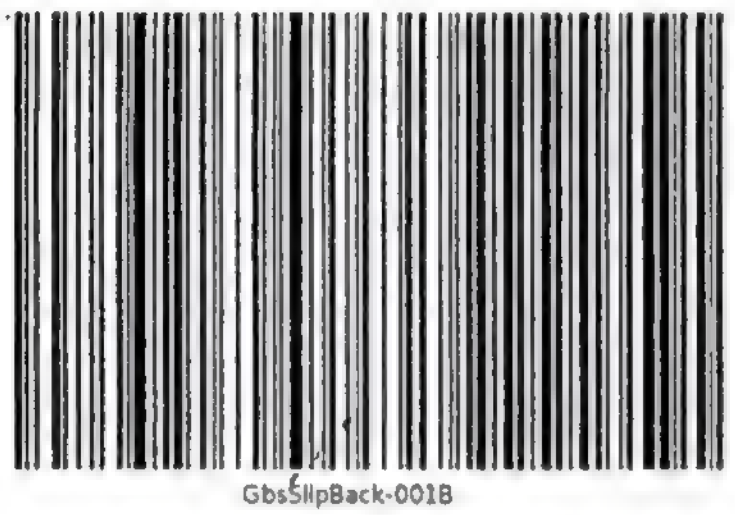

Back

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Ted Waitt
President

Mort Waitt &
Vice President

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SPEED DEMONS

The excitement of the first 286 and 386 PCs doesn't seem to apply today, as users find the progress from 20 MHz to 25 MHz to 33 MHz to 486-25 (yawn) to 486-33 to 586 part of a logical and expected progression. Users also know that what makes a PC fast may be more than a blazing CPU. It might be fast ESDI or SCSI hard disks and disk-caching controllers on file servers (see "Get Smart: High-Performance Caching Disk Controllers" in this issue), math coprocessors on CAD workstations, graphics coprocessors (likely based on Texas Instruments' 34010 chip) for desktop publishing, *Windows* and Presentation Manager workstations, and in-the-PC printer controller boards for complex desktop publishing pages.

In 1990 powerful 386 and 386SX portables with docking stations and external monitors will begin to replace desktop PCs in some offices; 386SX PCs will choke the high end of the 286 market as price differences drop to under $200; and by year's end the 486 will become a price competitor to high-end 386s. While the 486 chip costs more, it includes a built-in math chip and memory cache. Lastly, the rash of truly lightweight (under 7.5 pounds) 8088/86 portables will be joined by a handful of go-anywhere 286 and 386SX machines.

Integrated Services Digital Network: "I Still Don't Need" or "I Smell Dollars Now?"

BETTER VIDEO

Of all the benefits of the PS/2, the clearest has been the improved resolution offered by the 640 by 480 VGA video standard and the nonstandard 800 by 600 Super VGA extension. Subjectively, Super VGA looks about twice as good as VGA; the improvement is much more noticeable than VGA's improvement over EGA. Too bad the Super VGA standards committee—VESA, spearheaded by NEC—has little to show for all its meetings and attempts to define one universal 800 by 600 interface that all software could use.

To display 800 by 600 pixels, you need a multiscanning monitor or a multifrequency monitor. Multifrequency monitors (like the NEC MultiSync 2A) are cheaper, and for all the hubbub surrounding multiscanning monitors, it turns out that today's multiscanner typically falls just short of the electronic headroom needed to run tomorrow's video standard, so you need a new monitor anyway when you get a new video card. You can now order Super VGA–ready multifrequency monitors with most PC compatibles. Super VGA costs about $100 to $200 more than VGA—and it's worth the extra cost. The two main holdouts on the Super VGA revolution are the industry's 800-pound gorillas, IBM and Compaq, which want to move you up one notch further on resolution and two notches on price.

IBM's other PS/2 video standard, 8514, with 1,024 by 768 interlaced resolution, has been slower to take off. In fact, it's unlikely that 8514 will ever get off the ground. Why? IBM chose an inferior standard. Interlacing means the monitor displays the even-numbered lines, then the odd-numbered lines, taking two sweeps to produce a single frame. It's cheaper than noninterlaced video, but the flicker will drive you crazy. Don't believe anyone who says otherwise unless you've spent a day in front of an interlaced monitor. Most users will decide that 8514 isn't worth the headaches. Better bets are noninterlaced Texas Instruments 34010-based 1,024 by 768 boards. Compaq and Dell use the same Renaissance-designed board; NEC has a similar unit called the Graphics Engine. You can buy one of these for about the same price IBM gets for its board.

If you're buying PCs in 1990 to run *Windows* or the Presentation Manager, look at the emerging group of 16-inch monitors, which allow for more-readable multiple-window sessions than standard 13- and 14-inch monitors.

AFFORDABLE LASERS

Hewlett-Packard has continued its mastery of the laser printer market with the HP LaserJet Series IIP, a $1,500, 4-page-per-minute unit with a street price quickly approaching $1,000. Okidata and Toshiba chimed in with similar units offering slightly more features for slightly more money. And IBM produced what may be the best LaserJet Series II compatible yet; the $2,695 IBM LaserPrinter provides more speed and more fonts for the same price as the LaserJet II.

The laser printer you really want may well ship early in 1990: a next-generation LaserJet with infinitely scalable fonts but without the font-rotation/vector-clipping bells and whistles that make PostScript printers cost $2,000 more than LaserJet compatibles. HP and others are likely to make these available for no more than $500 to $1000 over the price of their current LaserJet-compatible printers. Scalable-font printers will drive demand for WYSIWIG (what you see is what you get) software, especially word processors. Unfortunately, true multifont displays won' t be here until late 1990 or later.

SOFTWARE JUGGERNAUT

As the industry matures and more good products appear, you could argue, it's unlikely that we'll ever again see the market dominance of a *Lotus 1-2-3* or Ashton-Tate's *dBASE*. Except for one thing: the *WordPerfect* juggernaut. In two years, *WordPerfect* has climbed from about 25 or 30 percent market share and a slight lead over *Microsoft Word* to a 60-plus percent market share. And it's not from technical superiority. Half a dozen word processors provide roughly all the features of *WordPerfect*, and it's a coin toss whether *WordPerfect* or *Word* is better. So why does *WordPerfect* have the market share? The most likely reason: unlimited toll-free support. WordPerfect Corp. plows a huge chunk of its revenues back in no-questions-asked, all-questions-answered technical help. Others offer free support; some offer toll-free support. But nobody does it with the style and class of

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PC EDITOR'S CHOICE R&R Relational Report Writer, V2.0 December 8, 1987

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LOOKING AHEAD: 1990

by Gus Venditto

The past year has been all talk and reaction, as far as major trends go. Very few new products have had a significant impact. Looking ahead to 1990: The big battle between EISA and Micro Channel architecture is absolutely up for grabs. And it's likely that the coming year won't see a clear winner.

There are, however, a few areas where the future seems clear.

■ 1990 will be another big year for *Microsoft Windows*. More mainstream applications will migrate to the graphical environment. Both end users and software developers will use *Windows* as a way station on the road to OS/2. OS/2 is going to need the razzle-dazzle of true multifont WYSIWYG displays before it hits the big time, and that technology won't be ready this year.

■ Hypertext-this and HyperCard-that programs will become the rage on PCs, as *Windows* applications become the front ends for large databases.

■ A strange parade of odd-looking alternatives to the mouse will pass through. All of them will be touted as representing the finest research into human physiology ever conducted, and all of them will fade into oblivion.

■ Outbreaks of viruses, timed to go off on some well-publicized future date, will cause utility software vendors to build vaccines into their programs.

■ DAT (digital audio tape) will become the hottest thing in the tape backup market, as prices drop dramatically.

■ SCSI ports will be built into some PCs as standard equipment.

■ SQL will grow in popularity as *dBASE* programming declines.

■ Processors won't get the same kind of speed increases we've seen for the past few years—33 MHz is the fastest a 386 is likely to tick for many months to come. Radio emissions from these power-mad devices are making systems design such a nightmare that computer manufacturers will have to discover a solution to this problem before latching onto 40-MHz 386s.

■ Finally, IBM will introduce yet another new graphics standard.

The bettors among you may want to know how many of last year's predictions hit the mark. We're eight to one: IBM disappointed us by not introducing a new graphics standard. The eight predictions that did come true serve as a terse summary of the past year's events. More lightweight laptops appeared. Intel introduced the i486, which had little effect on the desktop market in 1989. PCs shrank in size as more features were built onto the motherboard. The 32-bit version of OS/2 received lukewarm reviews. The Unix standard failed to settle down. *LAN Manager* for OS/2 became a hot topic and coveted product. The first EISA-machines-cum-servers showed up in the fall. And the RAM crisis ended as 1-megabit chips proliferated. ■

the people in the WordPerfect organization.

A quick survey of the other software categories:

■ In graphics, there's a sense that no PC product is really first-rate compared with Mac offerings like Aldus *Persuasion* and Microsoft's *PowerPoint*. The only new graphics products that will matter will run under *Windows* or the Presentation Manager. Software Publishing Corp. is taking a big risk by porting *Harvard Graphics* from DOS to the Presentation Manager before doing *Windows*. Given PM's slow takeoff, SPC may have the order backward.

■ If every word written about personal information managers (PIMs) in 1988 translated into a sale in 1989, this would be a robust market. But words have not become deeds. The word *PIM* is a broad umbrella covering three dozen programs that handle outlining; notetaking, text databases, and text retrieval; hypermedia; and tracking, calendaring, and time management. *GrandView*, *IZE*, and *PackRat* are all PIMs, but they're far from interchangeable. Perhaps the most balleyhooed, Lotus's *Agenda*, failed to catch on; its incredible complexity overshadowed its incredible ability. One hope for some of the fading PIMs: put them on a LAN and label them groupware. One new PIM to watch: *IBM Current*, which will be great even before the LAN version ships.

■ In desktop publishing, while *PageMaker* and *Ventura Publisher* slug it out at the high end, the low end has returned to life. Now the best of the under-$250 programs won't embarrass you (unless you use a dot matrix printer): Logitech's *Finesse*, DRI's *GEM Publisher*, and Pinpoint Publishing's *Express Publisher*. Next step for high-end products: better handling of color artwork, enabling users to design *any* publication on a PC.

■ Forms processing has emerged as a secondary market, led by Delrina's *PerForm*, a Technical Excellence finalist, and Indigo Software's *JetForm*. The future of the forms market may be not as standalone products but as intelligent extensions to databases, word processors, and desktop publishing programs.

BEST OF 1989

On the following pages, *PC Magazine*'s editors and frequent contributors have highlighted 30 of the year's best products. How were they selected? Most qualified for consideration by virtue of winning Editor's Choice status earlier in the year; we also selected from among promising new products that haven't yet received *PC Magazine* reviews. Working from this pool of possibilities, editors and *PC Magazine* contributors nominated their personal favorites to a board made up of associate editor Mary Kathleen Flynn, PC Labs director Fred Davis, editor-in-chief Bill Machrone, and myself, executive editor Bill Howard. Where several authors nominated the same product, we chose the author with the most hands-on experience to write the description.

We haven't chosen every piece of hardware and software that could be considered one of the best products of 1989. We filtered out previous annual winners that weren't new or substantially improved in the past year. For instance, while *Microsoft Excel for Windows* was a Best of 1987 and may well still be the best spreadsheet, it has not undergone any changes in the last two years. Winners of *PC Magazine*'s 1989 Awards for Technical Excellence (and finalists) are covered elsewhere in this issue, although we consider them among the year's best as well. Products are arranged in alphabetical order by company name for hardware, by product name for software. A complete list appears in the table of contents.

Before you make any big decisions over which laser printer to buy, we'd like to point out a few little things about the new Canon LBP-4.

The first of which is size. Unlike most "desktop" printers that need a space the size of a football field to fit in your office, the LBP-4 is compact. So it actually fits on top of your desk.

It also fits your budget. With an equally compact price of only $1,545.*

And it's the only laser printer in its class to offer built-in scalable fonts that let you set type from the smallest fine print to headline size. Without options or add-ons.

Plus a lot of other little extras that make it easy to print high-quality text and graphics right down to the smallest detail. Including Canon's convenient EP-L replaceable cartridge, and a versatile front-loading paper tray. It even prints envelopes.

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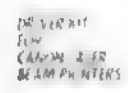
Very little to get

It's the first compact, affordable laser printer with scalable fonts, standard. And that's something to get excited about.



A printer driver kit is provided free with each new LBP-4 containing all printer definition files currently available for this printer on diskette, plus complete installation instructions.

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The Xircom approach has left the press full of praise: "The image of perfection–the way computers should be," wrote Steve Gibson in InfoWorld; "Incredibly easy to use...easy to install, easy to carry...a very clever device," according to Aaron Brenner at LAN Magazine.

You may think that all this "perfection" and convenience comes with a hefty price tag. It doesn't–in fact the Xircom family of LAN adapters costs about the same as the more traditional methods which it is quickly rendering obsolete.

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Adobe Streamline—Microsoft Windows Version

by Jim Seymour

Scanning in artwork is a great opportunity for desktop publishers. It lets you steal illustrations here and there—copying only public-domain images, of course!—and saves hours of tracing pictures into computer files. Till you have to *change* something in that artwork. Because editing scanned images is a pain at best. And if you scale them up or down, be prepared for some unpleasant surprises, as hairline rules suddenly grow to the thickness of fence posts.

Adobe Systems' $395 *Adobe Streamline—Microsoft Windows Version* is the answer. It lets you scan in line art from almost any source you can slap on the bed of your scanner, then processes the resulting scanned image into an honest-to-God PostScript file.

That file is editable with *Adobe Illustrator*, so you can make fine corrections. That's a good thing, because you *will* spend some time cleaning it up. Fiddling with *Streamline*'s Outline, Centerline, and combined Outline/Centerline modes will usually get you close to a publishable result, but not quite. It does make the final clean-up far quicker—and the results far better—than if you were trying to edit that bitmap-scanned image with a paint program.

FACT FILE: *Adobe Streamline—Microsoft Windows Version;* Adobe Systems Inc., 1585 Charleston Rd., Mountain View, CA 94039; (415) 961-4400. **List Price:** $395. **Requires:** 80286- or 80386-based PC, 640K RAM, 20MB available hard disk space, mouse, DOS 3.1 or later, *Microsoft Windows* 2.03 or later. 1MB expanded memory recommended. **Reviewed:** October 31, 1989, page 53.

CIRCLE 412 ON READER SERVICE CARD

Allways, The Spreadsheet Publisher

by Craig Stinson

Microsoft Excel may have been the first PC program to generate boardroom-quality reports directly from the worksheet, but in 1989 Funk Software's $150 *Allways* emerged as the spreadsheet publisher for the rest of us. Where *Excel* required users to adopt a whole new command structure and operating environment, *Allways* brought presentation capability to the millions of users for whom traversing the Lotus menu tree is as natural as walking.

Allways was the first add-in that allowed *Lotus 1-2-3* users to deploy fonts, type styles, rules, boxes, drop shadows, and shading, and to mix Lotus graphs on the page with their supporting numbers. It did all this, moreover, without requiring hardware upgrades

(a graphics-capable screen is a virtual necessity, but a 286 machine is not) and without making users abandon their familiar character-mode ways. For many users who don't yet have graphical user interface fever, the combination of *1-2-3* and *Allways* offers the best of both worlds: text mode for efficient manipulation of numbers and graphics mode for WYSIWYG manipulation of printing attributes.

Lotus was quick to recognize *Allways* as the card that could trump *Excel*'s most compelling attraction. The company immediately began bundling *Allways* with new copies of Release 2.01, and early in 1989 Lotus bought the rights to Funk's technology with the intention of incorporating it in *1-2-3*, Release 3.0. The fact that Release 3.0 went out the door in June without *Allways* technology (time ran out and Release 3.0 *had* to ship, goes the official explanation) was a major disappointment to would-be upgraders and a point of vulnerability that archrival Borland aggressively attacked.

Borland's *QuattroPro*, which debuted late in the year, incorporated publishing features well beyond those offered by *Allways*. But in the character-based spreadsheet world, *Allways* got there first and raised everybody's expectations of what an 8088-viable spreadsheet should do. After *Allways*, the day of the ugly spreadsheet printout was dead.

FACT FILE: *Allways, The Spreadsheet Publisher;* Funk Software Inc., 222 Third St., Cambridge, MA 02142; (617) 497-6339. **List Price:** $150. **Requires:** 384K RAM; *Lotus 1-2-3*, Release 2.0 or 2.01; DOS 2.0 or later. **Reviewed:** January 31, 1989, page 33.

CIRCLE 413 ON READER SERVICE CARD

Balance of Power—The 1990 Edition

by Jennifer Zaino

What makes a game qualify for the Best of 1989? Some observers say it's high-quality graphics and animation, others prefer the symphony of sound that MIDI card support brings. Still others demand a challenging test of hand/eye coordination.

Mindscape's $50 *Balance of Power—The 1990 Edition* won't win awards in any of these categories. Its graphics

are attractive but static; sound effects are nil; and you need only be able to operate a mouse with enough dexterity to select menu choices. What makes Chris Crawford's *Microsoft Windows*–based successor to his original

PHOTOGRAPHS: THOM O'CONNOR ILLUSTRATIONS: NORM BENDELL

Balance of Power a winner is its sheer intelligence.

As President of the United States (or Soviet General Secretary, if you prefer), you negotiate trade policies, provide military as well as financial support to allies, and generally deal with a host of political crises. The catch is that you must do all this without inciting the wrath of the other superpower.

If you do blow up the world, you'll be bumped back to DOS and greeted with a message that chastises you for your failure to maintain peace. In some ways, this chilling reprimand is more ominous than a graphic display of mushroom clouds and nuked flesh.

The challenge of devising a strategy that avoids nuclear war without sacrificing your country's prestige and position in global politics is intriguing. *Balance of Power* is food for the brain, and that's why it's a winner.

FACT FILE: *Balance of Power—The 1990 Edition;* Mindscape Inc., 34444 Dundee Rd., Northbrook, IL 60062; (708) 480-7667. **List Price:** $50. **Requires:** 640K RAM; *Microsoft Windows*, Version 2.0. **Reviewed:** September 12, 1989, page 382.

CIRCLE 414 ON READER SERVICE CARD

With *Balance of Power—The 1990 Edition*, your mission, should you choose to accept it, is to balance superpower politics with world peace.

It's not easy being Top Dog. You must keep up with newspaper reports and familiarize yourself with various countries' politics, economic conditions, literacy rates, and other demographics (the game boasts a database of facts updated through 1988). This difficult job also demands diplomatic finesse: you don't want to look weak to other countries, but any protests must be carefully thought out. Polite objections can all too soon lead to military threats and from there to all-out nuclear war.

CASIO INC
Casio B.O.S.S.

by John Dickinson

OK, it doesn't run DOS, *Microsoft Word*, *Lotus 1-2-3*, or anything else you might be familiar with, not even OS/2. But at $220 for the 32K version and $240 for the 64K version, the Casio B.O.S.S. (Business Organizer Scheduling System) fits in my shirt pocket, has a QWERTY keyboard and a legible 36-character by 6-line screen, and handily replaces a calendar and address book (which were too thick for my pocket).

And a software/hardware combination created by the jetsetters at Travelling Software links it to my PC's serial port and sends data in either direction at 9,600 bits per second. That lets me use both the PC and the B.O.S.S. to their best advantage, which mostly means minimizing the use of that wonderful but awesomely small QWERTY keyboard on the B.O.S.S.

I maintain my calendar on the B.O.S.S., because its typing requirement is minimal, and my telephone directory on the PC, where it's easy to type in a ton of data. One fringe benefit is that I now carry my entire business contact list in my pocket. Another is that the B.O.S.S.'s software makes it easy to search for appointments and free times, and even displays each day graphically.

The B.O.S.S. also features a memo organizer where you can store such things as frequent-flyer and credit-card numbers or passport and driving-license numbers. There is also a business card file similar to the phone directory but organized by company. For security, you can lock a portion of any file in a password-protected area. Other B.O.S.S. features include alarms for your schedule, local and world time clocks, a calculator, and even keyboard macros for typing frequently used entries.

The B.O.S.S. comes with 32K or 64K of memory, but I recommend the larger configuration. You can also

buy the same capability in a larger case with more typable keys. But I prefer keeping the B.O.S.S. in my shirt pocket, as handy as my right hand.

FACT FILE: Casio B.O.S.S.; Casio Inc., 570 Mount Pleasant Ave., Dover, NJ 07801; (800) 634-1895, (201) 361-5400. **List Price:** With 32K, $220; with 64K, $240; with 64K and raised keyboard, $260. PC link (software and cable), $110. **Requires:** 256K RAM. **Reviewed:** Not previously reviewed in *PC Magazine*.

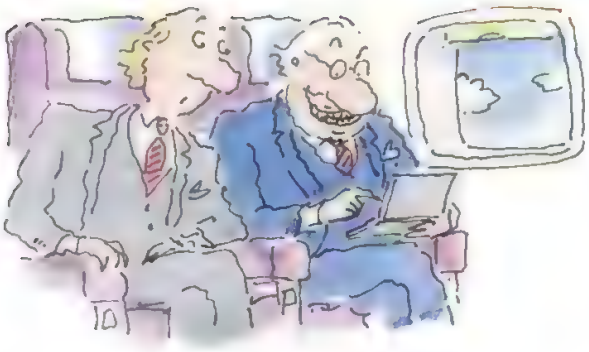
CIRCLE 415 ON READER SERVICE CARD

CHECKFREE CORP
CheckFree

by Milt Jones

If you'd really like a glimpse at how tomorrow-computing will change your life, forget OS/2, the Presentation Manager, and the 486. The *CheckFree* electronic bill-paying service belongs to that rare class of product that is forward-looking, universally useful, and available today.

No matter where you bank, *CheckFree* lets you pay your bills by PC and modem, drawing funds electronically



The Casio B.O.S.S. fits in a shirt pocket, handy as your right hand.

from your existing checking or NOW account. Because *CheckFree* uses the same electronic transfer system used by banks and the Federal Reserve, your bank has no choice but to go along.

Though related by virtue of its on-line nature to electronic banking, *CheckFree* operates more like standalone check-writing programs such as Intuit's *Quicken*. Just as

Quicken turns your instructions into printed checks, *CheckFree* turns them into electronic payment requests. It also includes a check register and a handful of utilities to help you balance your checkbook and monitor your personal budget.

You begin by entering all of your instructions into *CheckFree* off-line, using CheckFree Corp.'s *Servisware*. When you're ready to send the transactions, you simply choose the appropriate menu option. The program then transmits the data automatically.

CheckFree lets you schedule fixed, recurring payments with the press of a few keys. Until told otherwise, *CheckFree* will pay the amount at the specified interval without your lifting a finger. You can also schedule unfixed payments well in advance.

Perhaps best of all, however, *CheckFree* eliminates the hassles of writing and mailing paper checks, reducing the dreaded task of bill paying to practically nothing.

If you like the idea of *CheckFree* but are already hooked on another personal finance package, you may be in luck. *Quicken* 3.0 now supports automatic updating of its registers using *CheckFree* data, and it has also been announced that *Andrew Tobias' Managing Your Money* and *Checkwrite Plus* will support direct, seamless payment of your bills through *CheckFree*.

FACT FILE: *CheckFree;* CheckFree Corp., P.O. Box 897, Columbus, OH 43216; (800) 882-5280, (614) 898-6000. **List Price:** With startup package, user guide, and first month's service, $50 (XPRESS kit version, $30); monthly service charge, $9. **Requires:** 256K RAM, modem, DOS 2.1 or later. **Reviewed:** November 14, 1989, page 513.

CIRCLE 416 ON READER SERVICE CARD

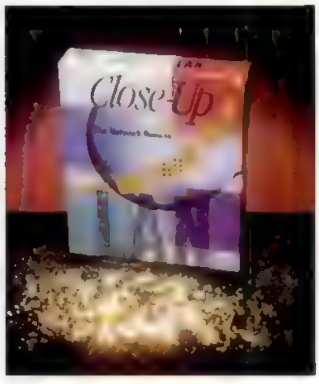
NORTON LAMBERT Close-Up/LAN, Version 2.0

by Frank J. Derfler, Jr.

The ability to control a PC remotely across a local area network is increasingly valuable for people with system support and training responsibilities. *Close-Up/LAN* from Norton Lambert is the premier program in a market segment with keen competition and explosive growth.

The planning and ingenuity in this program become evident when you install it or read its list of features. The designers have included features for people working in classrooms, across large campus installations, and in intensive multiprocessing networks. The package tests the network environment, determines what protocols are available, and configures itself to match the available transport environment. It handles graphics that others can't and serves in many different applications ranging from classrooms to one-on-one technical support.

Close-Up/LAN is one of the most useful programs in the connectivity market. It stands head and shoulders above the competition.



FACT FILE: *Close-Up/LAN,* Version 2.0; Norton Lambert, P.O. Box 4085, Santa Barbara, CA 93140; (805) 964-6767. **List Price:** For 2 users, $395; 8 users, $795; 16 users, $995; 32 users, $1,495; 64 users, $1,995. **Requires:** DOS 2.0 or later; Novell *NetWare*, IBM PC Local Area Network, or 3Com 3Plus; 75K RAM. **Reviewed:** October 31, 1989, page 233.

CIRCLE 417 ON READER SERVICE CARD

WILSON WINDOWWARE Command Post 5.2K

by Robin Raskin

Microsoft Windows has survived and thrived, but not without the help of MS-DOS Executive replacement utilities. The best *Windows* aid we've seen is Wilson WindowWare's $35 *Command Post*. It looks and acts just like the standard *Windows* menu, so it doesn't require a new mind-set. It doesn't make any enormous system demands on the already taxed *Windows* environment either. But it

adds all the functionality you'll need to keep you from tossing your *Windows* out the window.

Command Post adds a few all-important main menu options to the sparse MS-DOS Executive. A *Windows* menu orchestrates all open windows into neat stacks or tiles. A *Windows* locater assists those who are easily lost in a sea of open windows. The Desk menu provides a quick and personalized entrée into all the desktop utilities that come

standard with *Windows*. Most important is the Applications menu, which lets you personalize *Windows* by creating a customized list of your most frequently used applications and how you prefer to enter them.

For example, I launch *Corel Draw!* by creating a menu item called Drawing. I launch into *Microsoft Word* by clicking on Letters to Mom. Immediately I'm tossed into the proper subdirectory. Kiss goodbye the days of eye-balling a screen full of files for .EXE. *Command Post*'s newest version, 6.2K, launches multiple applications from a single menu bar, so I could launch my "Daily Apps" in a single mouse click.

Creating the necessary menus is trivial. You use any ASCII text editor or the Notepad to add a few lines to the CMDPOST.MNU file.

The latest version also includes a directory capability, much like the classic DOS-based XTREE. Finally, by keeping two *Windows* open, *Command Post* handles file transfers in a straightforward point-and-click fashion. Compared to other pricey MS-DOS Executive utilities, *Command Post* is a bargain.

Command Post just might keep you from tossing your Windows out the window.

Command Post doesn't use any flashy desktop metaphors and won't transform your PC into a Mac-alike. If you want a more icon-like interface, look at the more expensive, resource-gobbling *PubTech File Organizer*.

FACT FILE: *Command Post* 6.2K; Wilson WindowWare, 2701 California Ave. SW, #212, Seattle, WA 98116; (206) 937-9335. **Price:** $35. **Requires:** 18K RAM, *Microsoft Windows* 2.03 or later. **Reviewed:** October 11, 1988, page 48.

CIRCLE 418 ON READER SERVICE CARD

COMPAQ COMPUTER CORP

Compaq Deskpro 386/33

by Robert W. Kane

Although we didn't bestow a *PC Magazine* Award for Technical Excellence on any desktop PC this year, we do acknowledge the true quality of the Compaq Deskpro 386/33. A feat of solid engineering, this machine is the highest incarnation of existing technologies at the top of the performance scale for computers.

Completely redesigned both inside and out, the Deskpro serves as a model 33-MHz 386 PC. While not the fastest in terms of processor or disk performance, its overall speed places it near the top of the crowd. That it performs this feat with only a 64K processor RAM cache and no disk cache whatsoever is a testament to the superb craftsmanship that has gone into making it the fastest Compaq ever.

Of course, as with any finely crafted product, you'll pay a hefty premium for this Compaq gem. With a base price starting at $10,499, (2MB RAM, 84MB hard disk, no monitor), the 386/33 will put a serious dent in your wallet. In return, you'll get a top-of-the-line machine that will tackle your most formidable applications with ease day in and day out. With Compaq, you can afford to be demanding.

FACT FILE: Compaq Deskpro 386/33; Compaq Computer Corp., 20555 SH 249, Houston, TX 77070; (713) 370-0670. **List Price:** With 2MB RAM, 84MB hard disk, 1.2MB 5.25-inch floppy disk drive, VGA monitor, $11,198; with 320MB ESDI hard disk, $15,698; with 650MB ESDI hard disk, $18,698. **Reviewed:** October 31, 1989, page 126.

CIRCLE 419 ON READER SERVICE CARD

Don't just play around with CAD.

Powerful EasyCAD2 shatters the high-end CAD price barrier.

EasyCAD2's break-through $169.95 price tag, blazing speed and unparalleled features put high-end CAD within your reach.

Compare revolutionary EasyCAD2 to any other PC CAD program costing less than $500. There is no comparison. In fact, if you're drawing with anything less, you're just playing around. EasyCAD2 runs rings around software costing many times more. It even runs neck and neck with FastCAD, the fastest CAD in the micro world.

Others may charge extra for plot, DXF, and other modules. EasyCAD2's one-time $169.95 price is your ticket to CAD's fast lane.

EasyCAD2 is as easy to use as it is to buy.

Whether you're a CAD expert or a beginner, EasyCAD2 supercharges your productivity right from the start. Pull-down menus and dialog boxes simplify and streamline drawing. Use a mouse or digitizing tablet. Type on the keyboard or mix methods to enter commands and change drawings. Create custom macros and alternate menus for complex or repetitive tasks.

Numerous entities and editing commands.

EasyCAD2 comes with a full range of entities including points, lines, text, circles, arcs, boxes, polygons, splines, plus horizontal, vertical and parallel dimensions. Powerful editing commands let you erase, move, scale, rotate, break, trim, bend, fillet, copy, mirror and more almost as fast as you can think.

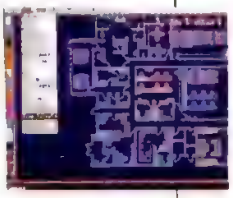
Stretch or shrink in a blink.

With EasyCAD2 commands like Scale, Stretch and Rotate you can actually lengthen or shrink parts of your drawings and dimensions are automatically updated. Unlike many other programs, you don't have to erase or re-enter them. Work with U.S. or metric formats, even change formats back and forth anytime while you're drawing.

As effective as programs costing ten times as much.

That's what one of the world's leading PC magazines said about EasyCAD2. We're so sure you'll agree, we back EasyCAD2 with a full 30-day money back guarantee. Call (602) 967-8633 now to place your order or for the name of your nearest dealer.

Choose from 16 colors, 256 layers. DXF format lets you exchange drawings and files with other CAD packages and spreadsheets.



PC WORLD BEST BUY

CORPORATE TOP RATED PCWEEK 1989 SATISFACTION POLL

EVOLUTION EasyCAD2 COMPUTING

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Tempe, AZ 85281-9936
Phone 602.967.8633

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CIRCLE 327 ON READER SERVICE CARD

LEAVE A WAKE-UP CALL FOR DECEMBER 1990

by Jim Seymour

Every year in the PC business, it's tempting to borrow Dickens's line "It was the best of times; it was the worst of times" for a look at the year's hits and misses.

Sure, it's overused, but it's hard to resist because the line is so close to the truth.

Unlike more-complicated organisms such as, say, slugs and snails, which seem to follow a proper Darwinian model (surviving and adapting when they learn from their mistakes and disappearing when they don't), some PC-industry executives seem to just rock along, blissfully (and obliviously) repeating their predecessors' faux pas.

Other PC chieftains rally their tribes, crank out great new products, learn from their mistakes and their peers' as well—and usually stay out of the headlines.

It's a rich stew.

Join us for a fast tour of some of 1989's highs and lows.

In late September, with the release of EISA-bus PCs drawing nigh, IBM PC boss Jim Cannavino called a remarkably unnewsy news conference, to announce, in effect, that IBM knew all along that third-party developers could make PS/2 cards communicate faster—if they'd just try a little harder. He went on to declare that this surely settled the question of whether the PS/2s' Micro Channel architecture bus was the new standard.

Right, Jim.

Sun Microsystems, one of the high-flyers in the computer business, broke analysts' hearts—and the back of the company's stock—with an early-summer announcement that the company would suffer its first down quarter. Sure enough, Sun went on to post a loss.

Why? They had . . . ahem . . . a little trouble getting a new . . . uhh, well . . . computer system, used to process orders, up and running.

Classy. *Very* classy.

WordPerfect Corp. continued to do nearly everything right. During the past two years—mainly during 1989—its share of the PC word-processing market soared from about 30 percent to more than 60 percent. It turns out that many paying customers *like* the idea of a software vendor that answers the phone when they call.

VPs Frank King and Frank Ingari kept proclaiming that Lotus's new *1-2-3*, Release 2.2, was in no sense "*1-2-3 Jr.*" but a full-fledged partner to the long-awaited Release 3.0. Meanwhile, the company packaged Release 2.2 in a cheap paper carton, with cheap perfect-bound manuals reminiscent of a drugstore paperback—and Release 3.0 got the full Lotus ring-binders-and-slipcase treatment.

Sure looks like *1-2-3 Jr.* to *us*, Frank(s).

As the new IBM display standard, 8514A, comes into wider use, new 8514A users love IBM (at first) for leading them towards higher-resolution displays, but soon learn why interlaced displays are not suitable for adult audiences.

After Rod Canion pulled Businessland's authorization to sell Compaqs, Businessland's founder, David Norman, proudly (desperately?) replaced them with Steve Jobs's new wonder, the NeXT workstation.

We shall now see how many people want to buy $10,000-plus workstations in storefronts.

Lotsa luck, Dave. But hey: it *is* a pretty thing.

Demonstrating that timing for which the company has become famous, Microsoft managed the last stages of development and manufacturing of *Word* 4.0 (for the Mac) and *Word* 5.0 (for the PC) so badly that it literally ran out of stock of the older versions—long before the new ones were ready.

Dealers screamed for product, but Mr. Gates couldn't ship 'em a thing; his cupboard was bare.

Ashton-Tate Corp. may have retired the Thumbs Down trophy. In 1989 we saw sales of its flagship product deBased still further, thanks to a slow, buggy *dBASE IV* 1.0 and still more delays on the long-promised network version 1.1; we saw *MultiMate* nearly disappear from the market, following the release of a classic too-little-too-late update; we saw feeble and nearly invisible promotion of *FullWrite Professional* and *FullImpact* (a very good word processor and spreadsheet, respectively, for the Mac); we saw distributors enraged over channel stuffing.

Oh, yes: we saw the value of the company plummet on Wall Street.

Sell it or liquidate it, Ed.

But maybe not: Borland's still in there trying.

It's hard to figure Borland these days. 1989 saw the near-disappearance of M. Philippe Kahn's highly touted *Spreeeent* word processor, and the near-disappearance of *SideKick*. Turbo Basic wasn't, so Borland gave up; *Quattro Professional* was, but very late; *Paradox* needs updating.

And, lest we forget, in the highlight of the PC social season, M. Kahn engineered a tacky dirty trick at Esther Dyson's annual PC Forum soiree, having copies of a magazine story slamming Lotus boss Jim Manzi slipped under attendees' hotel-room doors.

While trying to unsnarl the *1-2-3* upgrades mess, Lotus did one very smart thing: it left the Gross brothers alone to create one of the all-time great programs—*Magellan*.

Whatever you thought of *Hal*, the sort-of-intelligent *1-2-3* graft-on the Gross boys produced last time around,

we guarantee you'll like *Magellan*.

We just hope Lotus's "leave 'em alone" posture during Magellan's development doesn't extend to its marketing . . . which so far has looked pretty half-hearted.

Hayes, which once not only owned the PC-modem market but also demonstrated the best kind of market leadership, lost even more market share in 1989, and seems to have abandoned thoughts of supremacy.

Hayes's ISDN card remains vaporware (though still lots of fun after what, Dennis, three outings at Comdex?). Hayes had to buy JT Fax to get into the fax-card market it previously overlooked. And Hayes had to buy Practical Peripherals to establish a line of lower-priced modems.

Hello? Anyone home? Hello?

This year Adobe Systems increased its line of superbly executed PostScript typefaces even further. And it introduced good new products, from *Streamline* to *True Form* to *Adobe Type Manager*. But very good PostScript emulators are coming along from Bauer and Associates (bought by Microsoft), Phoenix (everybody's favorite BIOS cloners), and others, all of which pose a powerful threat to Adobe's largest revenue stream, PostScript interpreter licenses.

Adobe also lost a lot when Apple and Microsoft agreed effectively to freeze Adobe out of the next standard in high-quality on-screen and laser-printer fonts. Good thing that *type* business is going so well, guys. Before long those pricey PostScript licenses may be few and far between.

Tandy Corp. continued to grow, thanks to smart moves such as signing-on to OEM PCs for DEC and Panasonic. But when is Tandy going to get serious Symantec's *Q&A* this year, support from other software publishers fell off.

DeskMate remains convenient, if ugly. Is that enough to make it a standard in the marketplace? Or are the 7,000-plus Radio Shack storefronts all it really has going for it?

Hewlett-Packard knew the tiny new LaserJet Series IIP would hurt sales of HP's top-of-the-line Laserjet II and IID and also the low-priced DeskJet. But HP brought it to market anyway, making it highly compatible with its bigger siblings, and wonderfully small, with great print quality and a street price of under a grand.

Hewlett-Packard *deserves* to own this market.

It was an especially good year for printers. IBM continued its winning ways, with a spectacular LaserJet-compatible 10-page-per-minute desktop LaserPrinter—priced, incredibly, right with the HP it matches.

See, we *told* you those wonderful Proprinters weren't flukes. Score it Kentucky 1, Japan 0.

Oh boy, was it a good year for printers! QMS scored twice, with the ColorScript 10 Model 10, the first under-$10,000 300- by 300-dot-per-inch PostScript color printer, and again with the Turbo PS-810, a faster version of QMS's already-hot PS-810.

Apple thinks it has the high-end desktop laser market sewn up with the LaserWriter IINTX. Apple must not know that the Turbo 820 matches the NTX's print quality and features, including a SCSI hard disk port, for less money, and it prints a good deal faster.

Make that Kentucky 1, Alabama 1, Cupertino 0, Japan 0.

Whatever their motives, Apple and Microsoft did The Wrong more promise for a truly integrated future than any other imaging standard—and they are already in place on the printer side.

Other than as a chance to play kissy-face-and-make-up during the Mac vs. *Windows* lawsuit, it's hard to see how this is in the best interest of Microsoft, or why the company did it. Apple's the only winner: it needs all the validation it can get, and here's a nice dose from the DOS folks. The millions of people who'll use OS/2 (someday) are the big losers. And Adobe, of course.

Was bashing Adobe really worth it?

NEC botched the introduction of one of the most significant new PC products in years—the UltraLite laptop. First, there was the noninterchangeable battery debacle. Second, the not-available problem—it was almost impossible to find UltraLites actually for sale for most of the year. And third (three strikes and . . . ?), NEC has been incredibly slow in getting out the ROM-card-based software that could make the machine's limited (2MB maximum) silicon-hard-disk capacity make sense. Example: the same week Microsoft shipped Version 2 of *Works*—the ideal all-round program for an UltraLite user—NEC shipped the ROM-card version of *Works;* but that's Version 1.05 on the card, the code for which NEC got *nine months* earlier.

C'mon, guys: get serious.

OK, so IBM sounded silly when it made all those pronouncements about getting into PC software in a big way. We all remember the Fixed Disorganizer, the IBM *Planning Assistant*, and other canines from the Big Blue.

But this year IBM sneaked *Current* onto the market—a *Windows*-based PIM that showed good design and serious thinking about how people *want* to organize their "personal information."

Usually, the technology available to computer users just plods along—with competing products repeating one another's so-called improvements.

But once in a blue moon there's a great leap of innovation. Something new appears that's so well thought out, so smart, that the way you work may never be the same again.

WIZ™ by CalComp, for example.

WIZ is an exciting new productivity tool. Combining the easy-to-use features of a mouse with the power of an "intelligent" graphics pad to enhance every pointing, tracing and drawing function you do.

WIZ meets the needs of virtually every Macintosh and PC user—from novice to advanced. Because WIZ gives you the convenience and flexibility of six programmable buttons, a cross-hair pointer and 1000 dpi for pinpoint accuracy, along with

Prehistoric.

a user-definable mouse area.

What's more, WIZ unleashes the full power and speed of your software. Optional templates for most major programs eliminate tedious pull-down or bar menus. Because WIZ templates put the commands you use most at your fingertips for instant access. And for the artist in you, WIZ offers an optional pen for drawing.

There's no rolling ball or moving parts. Nothing to clean. And WIZ has a five year warranty backed by CalComp, a world leader in computer graphics for over 30 years.

But the most amazing thing about WIZ is that you get it all for an introductory price under $200.

See WIZ at your local dealer or call 800-CALCOMP.

WIZ by CalComp. Everything else is just a mouse.

WIZ

Historic.

CIRCLE 144 ON READER SERVICE CARD

COMPAQ COMPUTER CORP

Compaq SLT/286

by Bill Howard

Compaq's original reputation was built on portable PCs, but it wasn't until a year ago that Compaq overcame its inner angst—will users accept 3.5-inch disks? are backlit LCDs true displays?—and brought out a battery-operated portable.

The market quickly responded by making the Compaq SLT/286 the best-selling portable, and for good reason: Compaq was the first to produce a battery-powered portable that had substantially all the features you expected from a desktop PC, so you could use the same machine in the office and on the road. (And so what if Compaq charges $500 more than everyone else? It's cheaper than buying two computers.)

Others had parts of the equation, but Compaq came up with the whole enchilada in one 14-pound machine: detachable keyboard, VGA display, intelligent power management and automatic sleep mode, quick-change battery.

FACT FILE: Compaq SLT/286; Compaq Computer Corp., 20555 SH 249, Houston, TX 77070; (713) 370-0670. **List Price:** With 640K RAM, 20MB hard disk, 1.44MB 3.5-inch floppy disk drive, $5,399; with 40MB hard disk, $5,999. 2,400-bit-per-second internal modem, $599; 1MB RAM upgrade, $699; Desktop Expansion Base, $999; carrying case, $89; DOS 3.3, $120. **Reviewed:** July 1989, page 98.

CIRCLE 603 ON READER SERVICE CARD

CUMULUS CORP

Cumulus 386SX Card

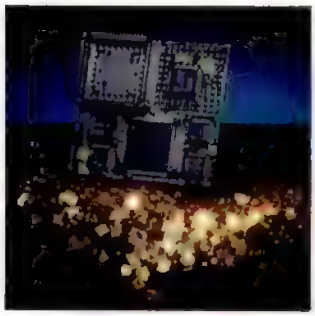
by Winn L. Rosch

With the 80286 long declared brain-dead, who will make the final move to pull the plug on this short-lived, obedient yet obsolete friend? Cumulus Corp. is the prime candidate, having crafted the first plug-in 80386SX replacement chip. A number of computer manufacturers have created proprietary 386SX-based upgrades that work only with their own system boards, but the $595 Cumulus 386SX Card will plug into nearly any 80286-based system board.

The benefits of the chip swap are many. With a 386SX Card installed, any aging AT has the same adept memory-handling abilities as the latest 386 machine. It can page through RAM and make LIM EMS 4.0 from extended memory. Best of all, it can run 386-specific programs such as *DESQview 386* and *Microsoft Windows/386*. In an 8-MHz AT, the 386SX runs at double speed; in faster computers it runs at the speed of the chip it replaced (up to 16 MHz). The optional 386SX blasts through numbers up to five times as fast as the supplanted 286 used to do.

You may lose an expansion slot because of the height of the small circuit board required to match the 386SX to the signals in the 286 socket. Still, the $595 spent on the 386SX card can add years of life to computers handicapped by the inadequacies of the 80286.

Chip swapping: the Cumulus 386SX Card is the first plug-in 80386SX replacement chip.



FACT FILE: Cumulus 386SX Card; Cumulus Corp., 23500 Mercantile Rd., Beechwood, OH 44122; (216) 464-2211. **List price:** $595. **Requires:** An 80286-based PC. **Reviewed:** December 12, 1989, page 48.

CIRCLE 420 ON READER SERVICE CARD

DOLCH COMPUTER SYSTEMS

Dolch P.A.C. 386-25C

by Mary Kathleen Flynn

For fast high-end portable computing, nobody beats the lunchbox-style Dolch P.A.C. 386-25C. With 32K RAM processor cache on the motherboard, this speed demon outran every portable computer PC Labs has ever tested.

Pitched by Dolch as a "desktop-replacing portable," the 386-25C is designed for number-crunching power users—such as high-powered executives who travel frequently but work within reach of a power outlet in hotel rooms and second homes. Pricey (starting at $8,000) and heavy (21 pounds), the 386-25C delivers all the speed, power, and expandability that high-end users need.

Options abound. Although the unit is intended mostly for AC use, you can buy a $399 20-pound 85-watt battery pack, which should give you an hour's worth of operation. The battery pack also includes

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2. Insert this sheet with
    1. Front side touching the free page
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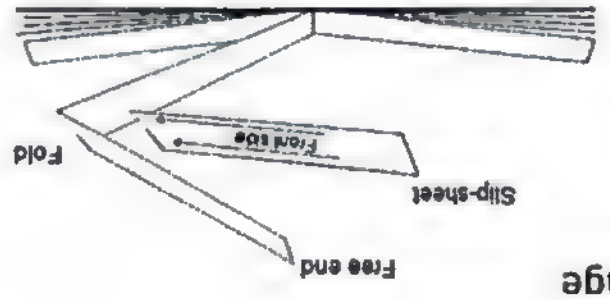
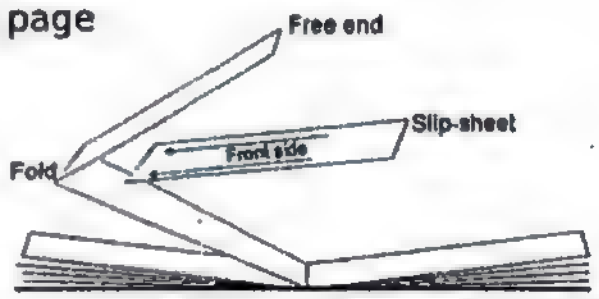
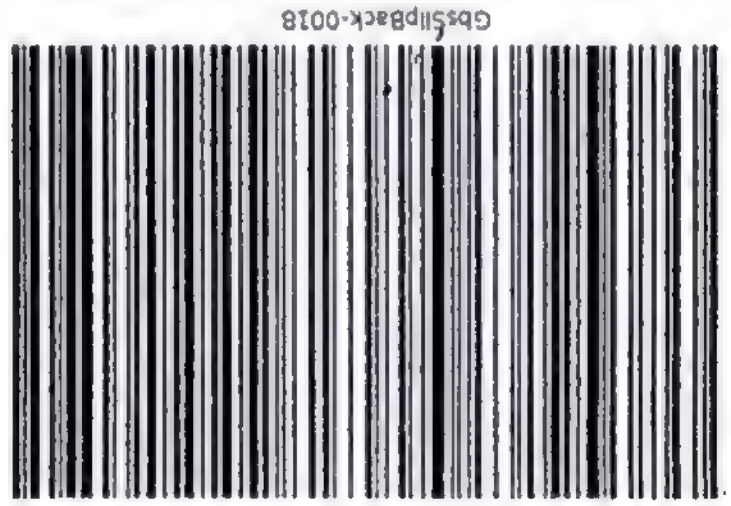
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



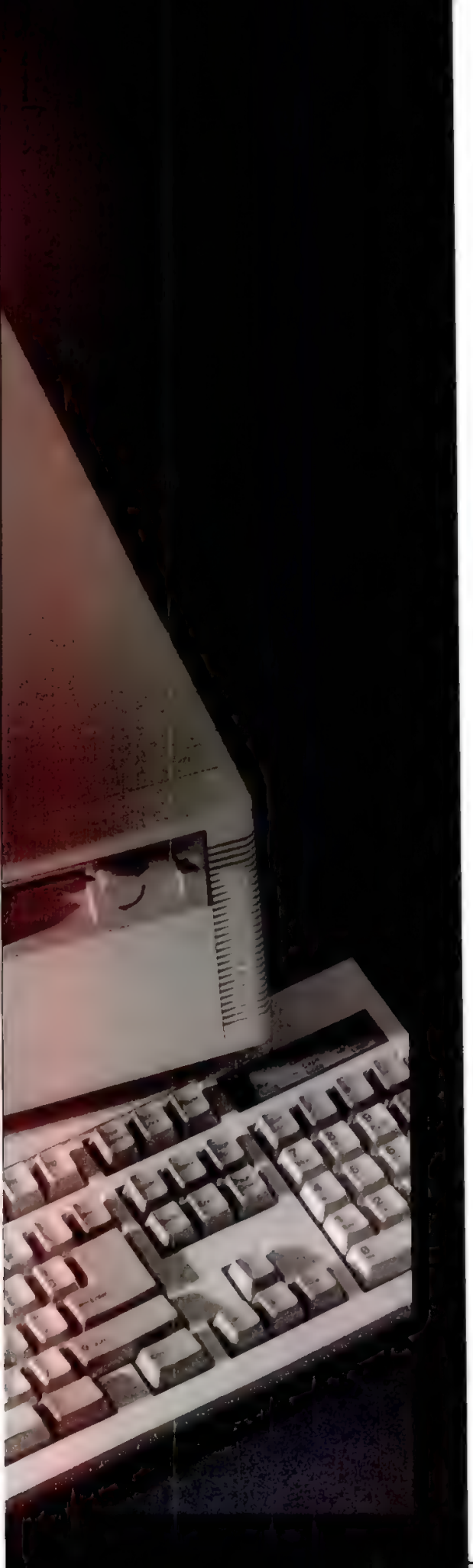


Back

1. Follow instructions on the other side

Inverted Back

1. Follow instructions on the other side



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Reason #1

"Overall Excellence."

As *PC Magazine* said "Price is always a consideration. So are benchmark test results. But both factors can be deceiving, which is why we consider them in the context of other aspects that will make the difference months and years down the road."

These are the attributes which *PC Magazine* used in awarding ZEOS the coveted Editor's Choice, not once but three times thus far in 1989. And "Overall Excellence" are the very words *PC Magazine* used in describing ZEOS systems comparing them to all others.

Reason #2

Dazzling Performance.

In their February 28th '386 review, *PC Magazine* awarded ZEOS Editors Choice. "The ZEOS '386 blows away every other computer... a smart choice" is what they said. And in a recent review, *Government Computer News* said the ZEOS 33MHz '386 is "arguably the fastest MS-DOS and OS/2 micro in the world."

Dazzling Performance is built into every ZEOS system. It's a key component of ZEOS Overall Excellence.

Reason #3

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PC Resource Magazine put it this way, "ZEOS... provides quality comparable with IBM or Compaq and does so for about 70% of the price." ZEOS uses only the very best components. And every system is fully tested and burned-in right in our own labs.

Reason #4

Value.

InfoWorld says, "We find the ZEOS '386 an excellent value. Speed: Excellent. Compatibility: Excellent. Value: Excellent." *Personal Computing* said, "ZEOS... is the best value we've come across... its performance is right up there with the slickest, most expensive PCs you can buy."

Reason #5

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Reason #7

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Almost unique in the mail order computer industry, ZEOS maintains its own chip level Research and Development staff. In addition to Systems Manufacturing, we also operate our own Board Level Manufacturing facility.

ZEOS has been involved in Research and Development since our incorporation back in 1981. Our strong and experienced Research, Manufacturing and Technical Staff translates into superior factory direct computer systems for you.

Reason #8

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In magazine after magazine and review after review ZEOS systems are sighted for Overall Excellence, for Excellent Value, as the Right Choice and so on. All of this is flattering but the most important thing is this: What do our customers think? Frankly, they love us. The systems and the support. That means more to us than anything.

Reason #9

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The Dolch P.A.C. 386-25C: the fastest portable on the planet.

an AC-DC adapter. If you need more than the three slots the standard unit provides, you can buy Dolch's Back-PAC expansion chassis, which contains three additional 16-bit slots and comes with its own 200-watt power supply. Although the 9-inch-diagonal electroluminescent flat-panel display that comes standard is only double-scan CGA, we recommend springing for the $595 VGA option. Other options include bigger hard disks, a 1.44MB 3.5-inch floppy disk drive, math coprocessors, modems, and an attractive carrying case. A comfortable detachable keyboard with numeric keypad comes standard.

For mobile high-end computing, the Dolch P.A.C. 386-25C provides the best of both worlds: the speed, power, and expandability of a 386 desktop and the convenience and small package of a portable.

FACT FILE: Dolch P.A.C. 386-25C; Dolch Computer Systems, 2029 O'Toole Ave., San Jose, CA 95131; (800) 538-7506. **List Price:** With 2MB RAM, 40MB hard disk, 1.2MB 5.25-inch floppy disk drive, electroluminescent flat panel display, $7,995; with DOS 3.3 or 4.0, $8,145; with 150MB hard disk, 80387-25 coprocessor, carrying case, $10,920. **Reviewed:** December 12, 1989, page 119.

CIRCLE 421 ON READER SERVICE CARD

Easel/2

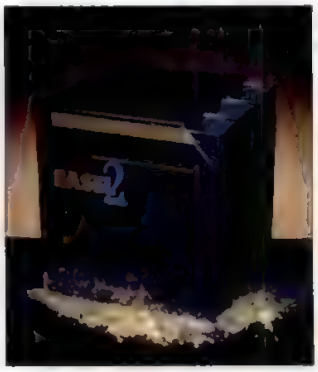
by Richard Hale Shaw

Developing applications for the OS/2 Presentation Manager has been the domain of well-seasoned programmers. If you didn't spend considerable time and money learning C and hadn't mastered the intricacies of OS/2 and PM, you couldn't begin to decipher a PM program—much less write one. With *Easel/2*, however, programmers can write PM applications and forgo C and PM experience.

Easel/2 is a comprehensive application development environment for the Presentation Manager. It features the EASEL programming language and a WYSIWYG interface design tool, Layout/CUA. With the latter you "paint" PM interfaces with objects like dialog boxes and controls like list boxes and push buttons, selecting them from a palette and positioning them on the screen. You can relate objects (for instance, making a dialog box appear when a push button is selected), and the program insures that the interface adheres to IBM's Common User Access guidelines. When you've finished the design, Layout/CUA converts the interface to an EASEL program.

The EASEL language hides the low-level details of PM programming by offering users a high-level, object-oriented approach that enables you to create shortcuts and reduce development time. In addition, the language offers users easy access to facilities such as the PM Clipboard. When an EASEL program is complete, you can compile it and run it either with *Easel/2* or the EASEL runtime package.

Easel/2 is a landmark product: it puts the power of PM into the hands of non-PM programmers. It could easily do what *dBASE* did in the early 1980s: provide a stable, high-level base for quality applications over the decade to come. We'd say that it's destined to remain among the best of the 1990s as well as the Best of 1989.



FACT FILE: *Easel/2;* Interactive Images Inc., 600 West Cummings Park, Woburn, MA 01801; (617) 938-8440. **List Price:** Development system, $7,500; runtime system, $350. **Requires:** 80286- or 80386-based PC, 1MB RAM, OS/2 1.1, EGA or VGA graphics adapter. **Reviewed:** November 14, 1989, page 33.

CIRCLE 422 ON READER SERVICE CARD

Fastback Plus Version 2.00

by Edward Mendelson

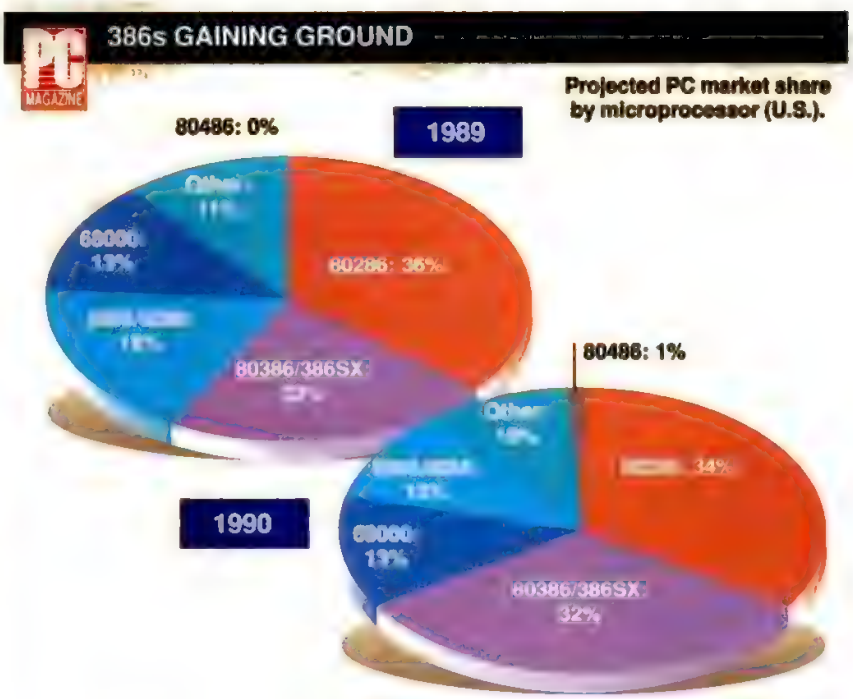
Blissful calm and breakneck speed normally don't coexist. But they do when you back up

1989: The Wait-and-See Year of PCs

by Stephanie K. Losee

In 1989 there was no escaping the 286/386 debate. Computer aficionados stood in front of their favorite magazine stands searching in vain for a nondebate cover story. Everyone had an opinion, and no one took criticism lightly. During discussion forums, industry authorities only barely avoided calling each other knuckleheads in person. And businesspeople looked at their recently purchased 286 machines and sighed.

In the end, magazine editors and industry gurus more or less agreed that the 286 was dead, and computer buyers more or less agreed that the 286 was alive. Even today, after all the hullabaloo, Dataquest estimates that 36 percent of all PC purchases are 286s, and 386s command only 21 percent of the market. But whether they admit it or not, even staunch 286 defenders realize that the future belongs to the 386, and in the world of personal computer technology the future is everything. In 1990 it's likely that a full 32 percent of the market will belong to the 386, and 286s will lose ground at 33 percent and falling. (See the adjoining chart, "386s Gaining Ground.")



Source: Dataquest, San Jose, California.

As a rule, every year PCs get faster and cheaper. This year, they also got smaller. Boxes took on new shapes, losing inches in width and gaining them in height. Slots were cut down from eight to five and placed horizontally. Some machines took on such a terminal-like appearance that it was tough to believe that a hard disk actually whirred inside.

What made this possible was the 1989 Motherboard Phenomenon: the tendency of PC manufacturers to load every imaginable feature onto the motherboard, short of a set of Ginsu knives. But just when it started to look as if video-on-the-motherboard might become ubiquitous, the trend slowed down. With VGA giving way to Super VGA and other higher-tech video stan-

your data with *Fastback Plus*. Fifth Generation Systems' $189 backup program manages to be both faster and safer than anything else on the market. There's more good news. *Fastback Plus* is flexible enough to work on anything from a solitary PC with a 360K floppy disk drive to a network that stores its backups on gigabyte-sized tapes or for that matter on optical disks.

The first time you run *Fastback Plus*, it presents a simple menu structure that lets absolute beginners back up quickly and easily. More advanced users can choose either of two increasingly complex menu structures that offer a wider range of options and fine tuning. All this flexibility is a real plus.

Because you can record a complete backup session as a macro, you can automate extremely elaborate backup procedures. These can include full backups of crucial directories, incremental backups of less important directories, and backups of one set of files to a floppy disk and another to a network server. The macro language even lets you include prompts to guide inexperienced users. If you ever have to restore one or two files instead of a full disk, *Fastback Plus* can automatically tell you which floppy disk has the file you need.

All this speed and convenience would be worthless if *Fastback Plus* didn't cradle your data against all possible mishaps. Few backup programs approach its sophisticated error handling. Even if your backup disks are badly damaged in storage, *Fastback Plus*'s error correction gives you a fighting chance to recover all your data in one piece.

The best feature of *Fastback Plus* is its refusal to compromise the integrity of your data. Even if you save

dards, it's no longer taken for granted that every 386 buyer will be satisfied with sugar-cookie VGA.

If some PCs started to look like portables (take a look at the breadloaf ALR VIP SX386 if you're skeptical), portables seemed headed toward laptop country, and laptops started to resemble notebooks. There's never as much movement in the laptop market as industry pundits might wish for, but even they can't complain about such innovations as the Zenith MinisPort and The Poqet PC. Portables shaved off some poundage; today you're more likely to hear about 15-pound luggables than the 20-pounders of yesteryear, although the unliftables still proliferate.

The bigger news is that 286 and 386 laptops are increasingly becoming mobile desktops. They've added larger hard disks, VGA screens, 20-MHz speeds, and even color. We've come to expect so much from laptops that it's incredible we can carry them at all, not to mention carry them with ease. And now that intelligent power management has arrived in the wake of the Compaq SLT/286, you don't have to worry about using up the battery 5 minutes after you type in your opening sentence.

Caught in the middle of this year's 286/386 battle was the much-maligned SX. First it was a 286 detonator. Then it was a waste of money. The arguments went back and forth, until we finally realized what was under our noses all along: the 386SX is simply yet another option for PC buyers. Comically, falling prices that were supposed to lead the SX into the 286 price range also pulled down the 386, so that now some brands are so similarly priced that the SX is difficult to justify. But the next price adjustment may pull the SX down to $500 or so below the full 386, just where it belongs.

This year's magic number was 33: the fastest speed PCs hit in 1989. One unexpected side effect of 33 MHz was emissions problems that may keep smaller computer manufacturers out of the market. As 386 speeds have soared and emissions have increased, manufacturers have had to compensate by building combat-worthy boxes. Smaller companies, which have tended to put new system boards in old boxes, may not be able to keep up with the more complex design needs of faster chips. This could mean disproportionately higher prices as low-end manufacturers drop out of the top speed bracket.

What may be the big disappointment of 1989 is Intel's i486 chip. Announced amid much fanfare and excitement, it's turning out that this greyhound may not be as fast as we originally hoped. Aside from its architectural improvements—8K static RAM cache controller, enhanced 387 coprocessor, integrated chip structure—the 33-MHz i486 was purported to be two to four times as fast as a 33-MHz 386. Instead, early PC Labs testing reveals speed gains to be only 20 percent, and now Intel will say only that the i486 will run at twice the rate of the 80386. As of this writing, the chip was still a few weeks away from its final incarnation, so almost anything can happen. But the bottom line is that the i486 isn't the revolution of the century. If you've been holding off from buying a 386 until the verdict is in on the 486, don't. One thing we do know is that 386 software will be compatible with the i486, so there's no reason to fear 386 obsolescence.

And EISA? The jury is still out on the impact (or lack of impact) it will have on the current market. One theory is that EISA's faster throughput is a benefit more necessary to servers than to desktop machines. IBM has already addressed the EISA question with its plans for new and improved Micro Channel, so IBM is covered if EISA takes off. (IBM has announced that future MCA machines will make the jump from a 32-bit data path to a 64-bit path, transferring data at a stunning 160MB per *second*.) But since PS/2 buyers invest in IBM as a company, rather than in the Micro Channel architecture, it's unlikely they'll invest in EISA machines simply for their architectural assets. Time will tell. ■

time by turning off its write-verification option, it still refuses to be fooled by bad disks that other programs are reckless enough to use without thinking twice. This is one program that's safe at any speed.

FACT FILE: *Fastback Plus*, Version 2.09; Fifth Generation Systems Inc., 10049 N. Reiger Rd., Baton Rouge, LA 70809; (800) 873-4384, (504) 291-7221. **List Price:** $189. **Requires:** 330K RAM, DOS 2.1 or later. **Reviewed:** August 1989, page 294.

CIRCLE 423 ON READER SERVICE CARD

FastLynx

by Rock Miller

Too often, the added power of modern hardware is used by software makers to add dubious features at the expense of ease-of-use. It's refreshing to see a product that pays attention to the basics. *FastLynx*, a $140 file-transfer package, stands out for the intelligence of its design, which makes its enhanced functionality easier, not harder, to use.

The best testament to *FastLynx* is that you literally

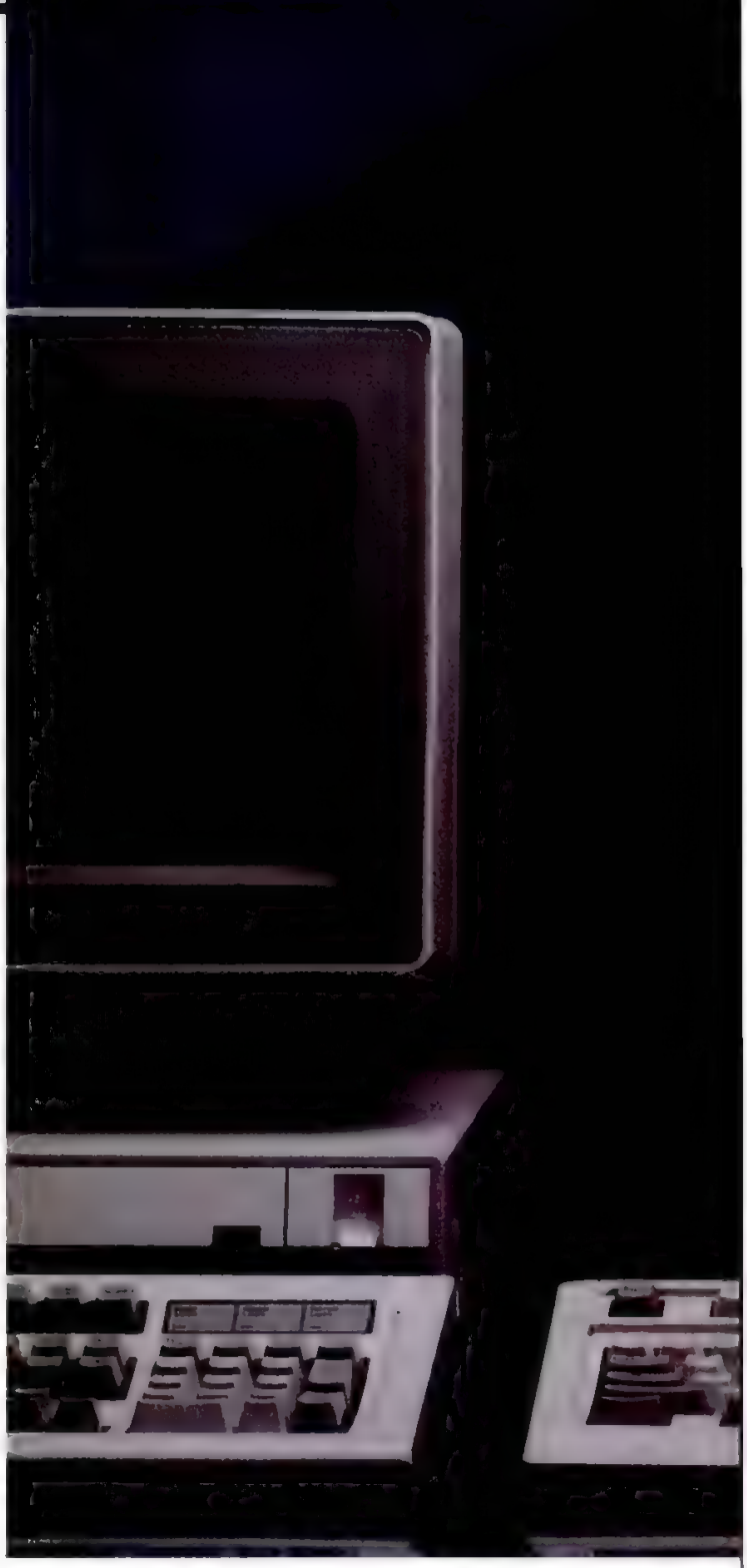
don't need the manual to use it. Installing it is as simple as copying and running it. Both *FastLynx* and its companion Expansion Box server program configure themselves automatically, and clear prompts guide you through manual tasks like uploading the program to a remote machine. You even get diagnostics to help you pin down transmission problems.

Once you've started, *FastLynx*'s consistency ensures that you won't have to fight to master it. Each function key does a single, easily understood task, which is clearly marked. The Escape and Return keys always do what you expect them to. When you do have options,

We're In A Perfect Position To Offer You 386 Performance On A 286 Budget.

FEATURE	IBM® PS/2 MOD 50Z	IBM® PS/2 MOD 55SX	TELEVIDEO TELE386SX™	COMPAQ® DESKPRO 286e	COMPAQ DESKPRO 386S®
CPU	80286	80386SX®	80386SX	80286	80386SX
Speed	10 MHz	16 MHz	16 MHz	12 MHz	16 MHz
Wait State	0	0	0	1	0
Std Memory	1 MB	2 MB	1 MB	1 MB	1 MB
32-Bit Software Compatible	NO	YES	YES	NO	YES
On-Board Video	VGA	VGA	VGA	VGA	VGA
Monitor	OPTION	OPTION	OPTION	OPTION	OPTION
Fixed Disk	30 MB	30 MB	OPTION	OPTION	OPTION
Price	$3250	$3850	$2339	$2699	$3299

Note: Information on this chart is based on published materials.



The comparison above will clearly help you and your customers chart a course through a sea of PCs.

As you can see, you really can upgrade your entire organization to all the speed, power and performance of 386™ computers.

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And you get more than just a great price, high performance and total compatibility with a Tele386SX.

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CIRCLE 227 ON READER SERVICE CARD

they're laid out clearly in windows or menus. Single-key shortcuts are few, so you can remember them and use them to advantage. Excellent context-sensitive help is available at every opportunity.

Best of all, you don't have to make concessions. Between its form mode and its command mode, you can tailor *FastLynx* to do anything its competitors can do, more easily. And it's no slouch in performance either, especially on faster machines that can take advantage of its turbo modes. A final touch: the parallel and serial cables provided in the package are of decent length and first-rate construction.

In the fast-moving world of file transfer software, *FastLynx* sets a standard to be matched.

FACT FILE: FastLynx; Rupp Corp., 835 Madison Ave., New York, NY 10021; (800) 852-RUPP. **List Price:** $140. **Requires:** 190K RAM, parallel or serial port on each computer, DOS 2.0 or later. **Reviewed:** October 17, 1989, page 44.

CIRCLE 424 ON READER SERVICE CARD

HEWLETT-PACKARD CO
HP ScanJet Plus

by Jim Seymour

Making good products even better was a fundamental theme in the PC hardware and software market this year. Hewlett-Packard's $2,190 ScanJet Plus is a good example. That it also made high-quality gray-scale scanning more affordable, at a time when everyone else's prices were climbing, wasn't bad either.

The ScanJet Plus produces state-of-the-art 256-step gray-scale scans. It also offers a variety of other scanning techniques, including an exceptionally useful diffusion scan that (uniquely) works well with screened originals that have already been put through a halftone process. And the ScanJet Plus does all this with slick, easy-to-use software.

Another example of the intelligence and convenience of the ScanJet Plus's design is that the same product works with both PCs and Macintoshes, so if you need to share the machine with someone else who has one of those funny fruit-boxes, you won't have any problems. All you have to do is buy a second interface kit.

Finally, the product simply reeks of HP's traditional quality, right down to the manual and installation instructions. Scanning has never been so easy—or so good.

FACT FILE: HP ScanJet Plus; Hewlett-Packard Co., 19310 Pruneridge Ave., Cupertino, CA 95014; (800) 752-0900. **List Price:** $2,190. **Requires:** 80286-based IBM-compatible PC; DOS 2.0 or later; graphics adapter. 640K RAM and mouse recommended. **Reviewed:** Not previously reviewed in *PC Magazine*.

CIRCLE 425 ON READER SERVICE CARD

IBM CORP
IBM Current

by Gus Venditto

I'm a PIM developer's worst nightmare. No personal information manager out there has ever come close to satisfying me.

I have hundreds of contacts and dozens of interests, all of them overlapping. I refuse to categorize people or relationships. I need an auto-dialer and an appointment scheduler, but I'm never going to settle for the preordained categories that any sensible database-oriented program is going to require of me. And I'm never going to maintain the discipline of giving the system *all* of my appointments, contacts, and miscellaneous tasks.

And yet *IBM Current* is winning me over.

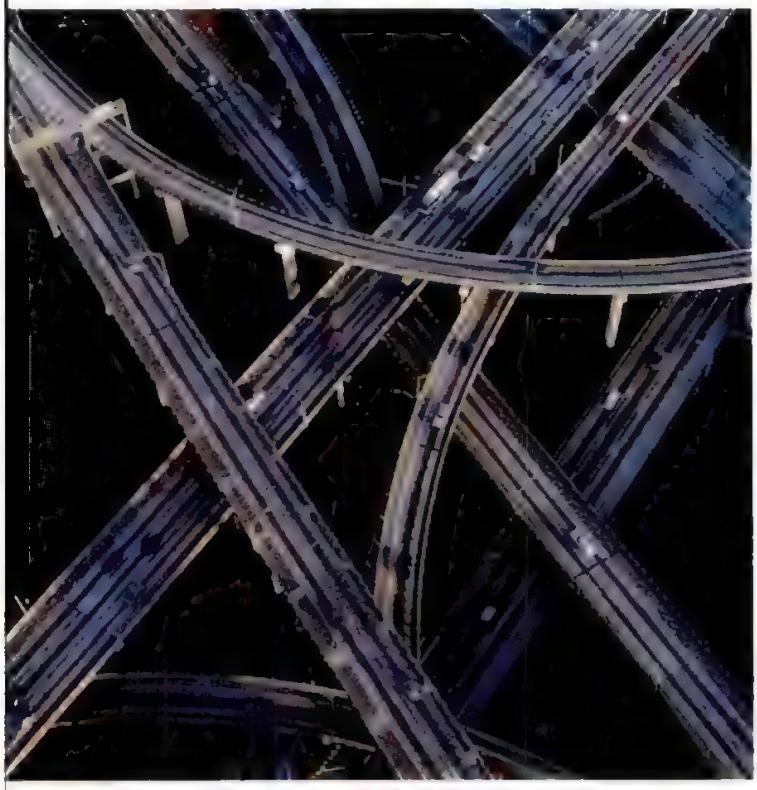
This $395 *Microsoft Windows* app starts out with the same kinds of routine approaches to personal organization that a dozen other programs have; it has card files for people, date books for appointments, and outliners for task management. But they're all flexible, not just in details but in actual structure. Fields can be linked or unlinked with a couple of mouse clicks.

I can decide to create a check-off box for my phone call log that assigns a call to a particular project; when the project's done, I eliminate the check-off. (Professionals who bill clients for phone discussions can set up their phone logs to calculate fees for elapsed phone time automatically.) Or I can decide to link travel expenses to appointments, so that I'll be more diligent at remembering to record all my cab fares.

It's all so flexible that *IBM Current* is a model of how software should work: it provides a framework for getting chores done that can

***IBM Current* puts the *personal* back into PIMs.**

There are two ways to get into your programs.



The DOS way.

DOS . . . the one way, no passing, twisted, backed-up path you use every day to get into your programs.

If you've had it with directories, backslashes, typos, and mumbo-jumbo program names, then get behind the wheel of new Direct Access™ 5.0. And zip into programs in just a keystroke.

Turn on your computer and up pops the Direct Access menu screen. Simply press the key that matches the program you want (like your word processor, spreadsheet, or database) and bang—you're in. Or use your mouse if you want. No extra typing. No mistakes. No complications. Entry so fast, you'd better wear a seat belt.

Direct Access also gives you password protection, so unauthorized users can't get into your applications.

The Direct Access way.

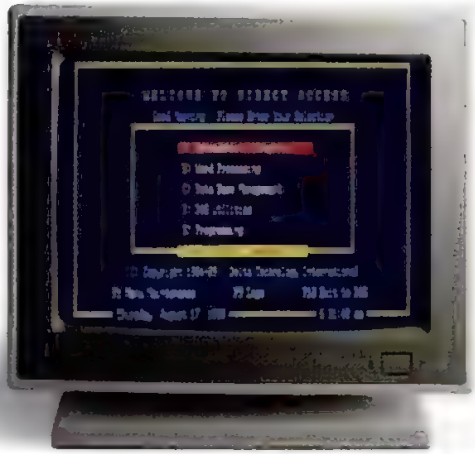
Quick and quiet virus detection that checks your applications for dangerous computer viruses. And newly enhanced usage tracking that shows how much time you're spending in your programs. It even searches your hard disk for programs and automatically builds your menus for you. There's a special version just for networks, too.

Even the critics love Direct Access.

PC Magazine named Direct Access as the Editor's Choice for menuing software: "Whether you need a menu system for a company-wide installation or yourself, Direct Access is the way to go."

When you consider everything Direct Access gives you for just $89.95, it's no surprise it's the number one menu software in the world.

Isn't it time you got into your programs without a roadmap and compass? Write or call Delta Technology International today for more information, or look for Direct Access at your software dealer.



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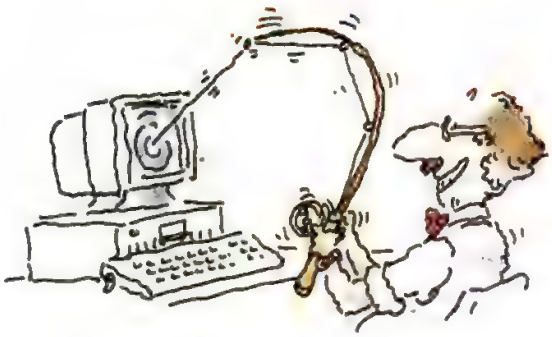
CIRCLE 256 ON READER SERVICE CARD

always be changed whenever the need arises. It gives me lots of options, not restrictions, and it puts the *personal* back into PIMs.
FACT FILE: IBM Current; IBM Corp., (800) IBM-7699. Contact your local software dealer. **List Price:** $395 (with runtime version of *Microsoft Windows*). **Requires:** 640K RAM, 80286- or 80386-based IBM-compatible PC, DOS 3.3 or later. **Reviewed:** December 26, 1989, page 38.
CIRCLE 426 ON READER SERVICE CARD



IdeaFisher: a tireless brainstorming partner.

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IdeaFisher

by Bill Machrone

Imagine a brainstorming partner who never gets tired. Who has impressively encyclopedic knowledge of world events, news items, people, and places. Who never laughs at your ideas. Who doesn't look askance at some of the associations you make. Who can learn from you.

That's *IdeaFisher*. Think of it as a thesaurus for ideas: a 7MB collection of associations, images, and phrases. Not everyone needs a product like this, nor will everyone enjoy using it. Just as a thesaurus will remind you of words you might otherwise have overlooked but won't help you write a clear sentence, *IdeaFisher* will give you a concept to work with but can't put it into your context.

Using *IdeaFisher* takes a little practice. Enter something too general and you'll get back hundreds of associations, far too many to deal with. Tighten up your specification and the number of hits plummets. They get more germane, too. There's little danger of missing a good one. *IdeaFisher* also has a notepad capability where you can record your impressions as the light bulbs go on in your head. There are many ways to zero in on the ideas or images you're looking for—too many to describe here.

IdeaFisher will be a boon to marketers, copywriters, aspiring novelists, publicists—just about anybody who works with creative ideas and associations. At $495, it's downright cheap for a secret weapon—and that's what everyone who's embroiled in the endless war of ideas and images needs. If you buy a copy for yourself, chances are you won't be telling your coworkers about it.
FACT FILE: *IdeaFisher;* Fisher Idea Systems Inc., 18881 Von Karman Ave., Ground Floor, Irvine, CA 92715; (714) 474-8111. **List Price:** $495. **Requires:** 7MB available hard disk space, 640K RAM, DOS 3.0 or later. **Reviewed:** Not previously reviewed in *PC Magazine*.
CIRCLE 427 ON READER SERVICE CARD

IQ ENGINEERING
IQ Engineering Super Cartridge 2

by Edward Mendelson

The moment you realize that the Super Cartridge 2 is the best choice you could have made in font cartridges is the moment when you forget it's there. Before you installed IQ Engineering's superbly built $649 cartridge, you never knew whether you could print that technical or foreign character in the font of your choice. With the Super Cartridge 2 plugged into your LaserJet, you eventually start taking for granted that you can print virtually anything in any of dozens of well-designed fonts.

In 1988, IQ Engineering was first to introduce a LaserJet font cartridge that vastly exceeded the Hewlett-Packard models. Since then, a half-dozen competitors—including Hewlett-Packard—have tried to catch up. None has even come close. The Super Cartridge 2 contains the widest available range of fixed-pitch and proportional text and headline fonts with extensive symbol sets and the best available range of point sizes, including the rare and indispensable 11-point. It comes with software drivers for use with every major application—even *Microsoft Windows* and *Ventura Publisher*.

A $399 reduced version, the Super Cartridge 2LC, has the same character sets as the Hewlett-Packard *WordPerfect* Cartridge but has far-better-designed fonts. And you can upgrade to the full Super

Cartridge 2. A new $699 expanded version, the 2L, has switches that let you choose from more than 200 fonts without preventing you from using soft fonts, the way some rival cartridges do. A landscape version of the Super Cartridge 2 costs $749. Any of these cartridges transforms the LaserJet from a fast typewriter into the printer it should have been in the first place.
FACT FILE: IQ Engineering Super Cartridge 2; IQ Engineering, P.O. Box 60955, Sunnyvale, CA 94088; (800) 765-3668, (408) 734-1161. **List Price:** $649; Super

The expandability of our 386SX lets you carry a lot of clout.

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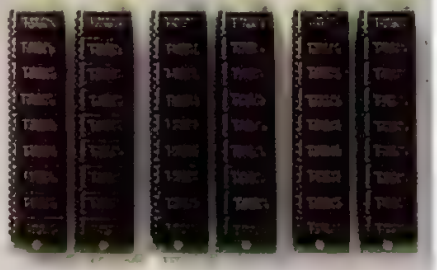
Desktop Clout. *A 91-key keyboard (101-key keyboard compatible) comes complete with separate cursor control and numeric keypad, making the T3200SX a true desktop replacement. Plus, a built-in port lets you attach a 101-key enhanced keyboard.*

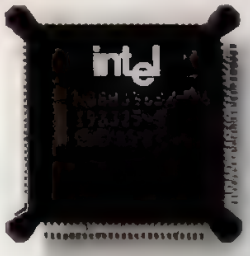


Memory Clout. *Three dedicated internal expansion slots let you increase memory up to 13MB as your need for power grows.*

Graphics Clout. *For exciting business presentations, the T3200SX's VGA graphics system can be teamed up with a color VGA monitor for simultaneous dual-screen viewing.*

Communications Clout. *With a dedicated modem slot, there's no need to take up valuable expansion space.*

Portable Clout. *The T3200SX also gives you the power to take it with you. At just 17.0 pounds, it lets you work wherever you work best.*



Performance Clout. *A 32-bit 80386SX processor lets you harness both today's and tomorrow's most advanced software.*

It used to be that the only way to get 386SX technology with the expandability of 6 internal expansion slots and 5 built-in ports was with a bulky desktop computer.

But that was before we developed the T3200SX. Not only does it carry all this clout, but it carries it in a sleek, 17.0-pound package that easily replaces desktop computers.

So whether you're networking, doing computer aided design, data bases or complex spreadsheet analysis, you can now work just about anyplace there's an AC outlet.

And it's priced lower than you'd expect for a PC with this kind of power and portability.

So now you can harness the power of all the latest 386 applications in an expanded range of working environments.

Namely, anywhere you want.

T3200SX: 17.0 pounds, 16MHz 80SX with 80387SX 16 coprocessor socket, two internal IBM compatible slots, three dedicated Toshiba memory slots, one dedicated Toshiba modem slot, 5 built in ports, 40MB hard disk with 25msec access, 1MB RAM expandable to 13MB, gas plasma VGA display with 16 gray scales, 1.44MB 3½" diskette drive. All Toshiba PCs are backed by the Exceptional Care program (enrollment required). IBM is a registered trademark of International Business Machines Corp.

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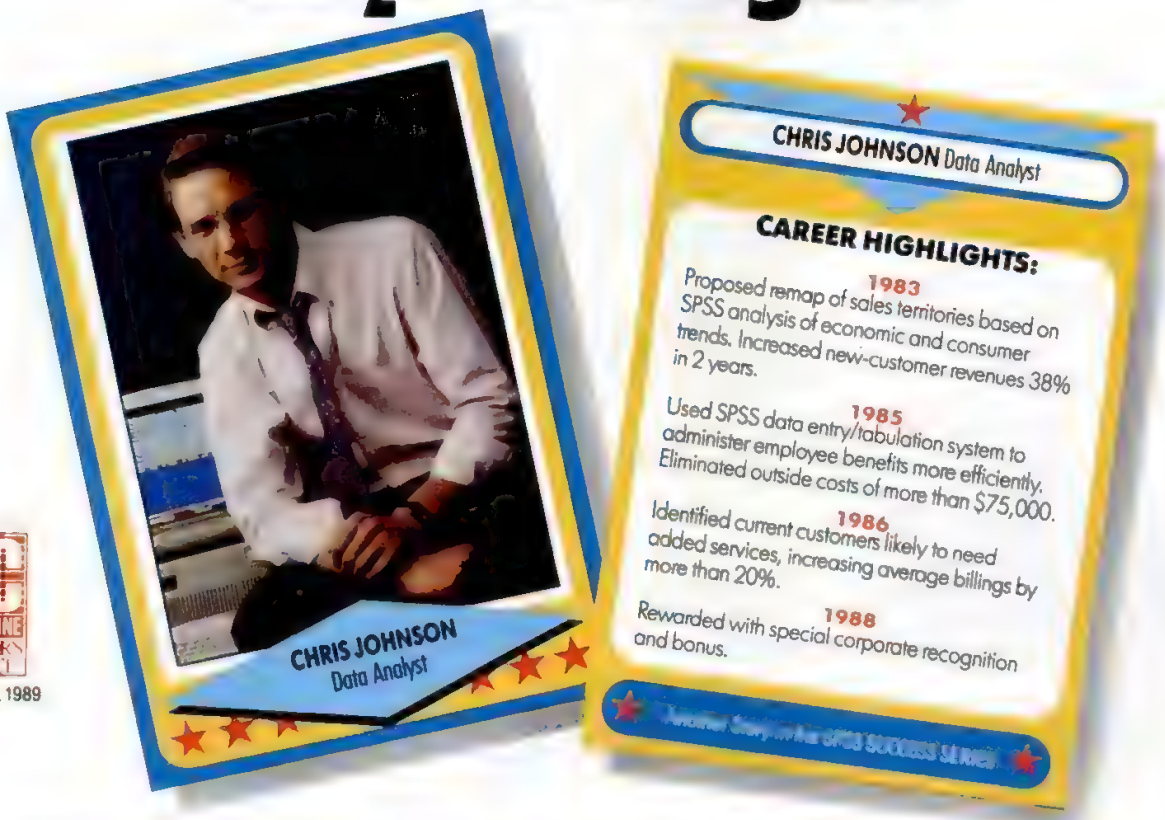

PC MAGAZINE EDITOR'S CHOICE
March 14, 1989

Data analysis software from SPSS gives your PC a winning advantage.

It doesn't matter which field you play hardball in. With the right combination of equipment and ability, you can be a hero.

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With SPSS and its options, you can interface directly with data from your database, spreadsheet or other application software. Then manipulate it in countless ways. From data entry to advanced statistics, forecasting, presentation and more.

Voted #1 by the fans.

When the readers of *PC Week* chose the top statistical software for "user satisfaction" (12/5/88), their choice was SPSS. And no wonder.

SPSS is designed not only for your computer's operating system, but also for its operator. With menu and help systems, plus an on-line statistical glossary. So you're always in control. For market research, sales analysis, quality control and more.

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CIRCLE 101 ON READER SERVICE CARD

Cartridge 2L, $699; Super Cartridge 2LC, $399. **Requires:** Any HP LaserJet Series II or compatible printer. **Reviewed:** June 13, 1989, page 228.
CIRCLE 428 ON READER SERVICE CARD

Lharc

by Barry Simon

Long used on bulletin boards (BBSs), file compression programs that place related files in a compressed archive have become essential for businesspeople stretching their hard disks and software publishers squeezing as much as possible onto disks. After a 1988 court case, ARC wars broke out on the BBS circuit, with SEA's *ARC* and Katz's *ZIP* as the two main contenders.

In March a third contender appeared from a most unlikely place, belying the theory that we needn't fear Japanese competition in software. A group of Japanese hackers discussed compression among themselves. One of the resulting programs, Haru-syasu Yoshizaki's *Lharc*, was uploaded to Genie one day in March and swept the BBS circuit within 24 hours.

Lharc often got 20 to 30 percent better compression ratios than *ZIP* or *ARC* (reducing files usually to 30 to 50 percent of their original size). It took longer but by less than a factor of two. Normally, the person extracting a compressed file needs a special extraction program, but as an option, one can add self-extraction code to the archive to produce a program that, when run, uncompresses itself! For *ARC* and *ZIP*, the overhead for this was 10 to 15K; for *Lharc*, an amazing 1.5K!

Lharc introduced a number of other innovations: you could include a special batch file (AUTOLARC.BAT) that would run after decompression, and you could add a preliminary information screen. And best of all, *Lharc* is totally free (though it is copyrighted); even source code is available.

An improved *ZIP* was released in August that incorporated some of the *Lharc* innovation with comparable compression and greater speed. But hang on; *Lharc* 2.0 should be out by the time you read this.

FACT FILE: ***Lharc;*** available from PC MagNet's UTIL-FORUM LIB 2 as LH1\13C .EXE and from other BBS systems; available from shareware/public-domain disk vendors including PSL; P.O. Box 3705, Houston, TX 77235; (800) 242-4775. **Requires:** 256K RAM, DOS 2.0 or later. **Reviewed:** Not previously reviewed in *PC Magazine*.
CIRCLE 429 ON READER SERVICE CARD

Panasonic KX-P1124

by Jonathan Matzkin

With laser printers cracking the $1,000 barrier, dot matrix printer manufacturers have to supply more and more features at ever-lower prices in order to compete. The Panasonic KX-P1124 proves that dot matrix printers can indeed hold their own, even in the face of competition from inexpensive lasers. With a list price of $500 (and often advertised for about $320), this economy-priced 24-pin unit delivers solid performance, a wide range of features, and good-to-excellent output quality at prices that would have been completely unthinkable just a few years ago.

The KX-P1124 offers everything that a personal or small-business user on a budget could ask for in a narrow-carriage unit. Print quality is fine for all but the most important correspondence; the five internal fonts add polish to any document. The KX-P1124 has three separate paper paths, making it flexible enough to fit into even the tightest office spaces.

Panasonic's front control panel may intimidate most neophyte users, but after a short time, feature selection becomes second nature. The front panel conveniently accesses virtually all of the printer's features.

Overall, the KX-P1124 represents an excellent choice for anyone with modest printing needs and an aversion to the high price tags that laser printers carry.

FACT FILE: Panasonic KX-P1124; Panasonic Communications & Systems Co., Office Automation Group, 2 Panasonic Way, Secaucus, NJ 07094; (800) PIC-8086, (201) 348-7000. **List Price:** $500. **Dimensions (HWD):** 5.6 x 16.9 x 14.1 in. **Weight:** 18.7 lbs. **Emulations:** Epson LQ-2500, IBM Proprinter X24. **Reviewed:** November 14, 1989, page 302.
CIRCLE 542 ON READER SERVICE CARD

PC Tools Deluxe, Version 5.5

by Edward Mendelson

If you install *PC Tools Deluxe* with the idea that you'll use it every now and then for its backup program, file manager, and perhaps one or two other utilities, you may be in for a surprise. Central Point Software's $129 jack-of-all-features has evolved into a collection of utilities and applications that you can use from the moment you turn on your computer to the moment you turn it off.

The new Version 5.5 combines the classic disk utilities of the original *PC Tools* with a desktop full of miniature but powerful applications, ranging from notepads to schedulers to calculators, plus a database

1989: The Year in Operating Systems

by Charles Petzold

Was 1989 different from 1988 in the world of operating systems? Not for the vast majority of users. 1989 was certainly not the year in which DOS was dethroned as the operating system of choice for IBM-standard PCs. DOS still reigns supreme. It has big momentum and will probably hold onto its preeminent market position for the next few years.

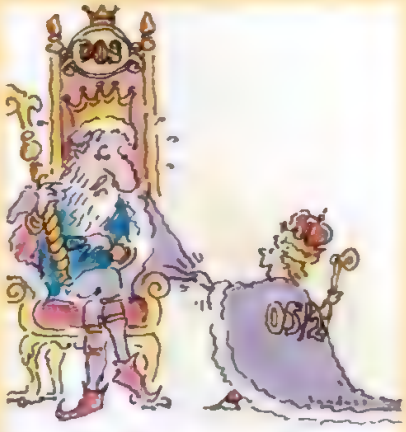
But DOS is not getting better as it gets older. Version 4.0, the most recent release (1988), has a graphics-based shell and expanded memory support, but few people even bother to use the shell, and the other enhancements don't begin to address DOS's most fundamental failings. Indeed, PC programmers spend more time than ever making end runs around DOS rather than using its facilities.

How bad DOS has become can be illustrated with one example from a 1989 application: When programmers at Lotus tried to cram all the functionality of *Lotus 1-2-3*, Release 3.0, into 640K of memory, they hardly had any room left for a spreadsheet. Their solution was twofold: Release 2.2 was a deliberately stripped-down version so that it could fit into 640K; Release 3.0 uses a 286-based DOS extender, one of several enhancements to plain-vanilla DOS that have become popular in recent years.

When programs such as *1-2-3* need to take on their own memory management, perhaps a more radical alternative to DOS is required. Since December of 1987, the proposed solution from IBM and Microsoft has been OS/2, a protected-mode operating system, which gained a built-in graphical user interface called the Presentation Manager in Release 1.1 (October 1988).

September 1989 saw the IBM release of OS/2 1.2. This new version includes the High Performance File System (HPFS), which supports large volumes, long filenames of up to 254 characters, and extended attributes. Perhaps the most significant long-term enhancement is extended attributes, which allow ASCII or binary data to be associated with a file via keywords similar to DOS environment strings. This means that a file can be associated with the program file, allowing you to invoke the program when you call the original file. That feature lays the foundation for a true object-oriented file system (OOFS) in the future.

OS/2 1.2 also includes some improvements in Presentation Manager (PM) visuals, such as push buttons with a 3-D look and color icons, and an enhanced shell with an icon-based program starter. The lack of printer drivers in OS/2 1.1 was corrected with the release of drivers for PostScript, Hewlett-Packard LaserJet, and Epson printers.



What OS/2 needs most, of course, is applications. The long wait is over. In 1989, OS/2 (albeit non-PM) versions of heavy hitters such as Lotus *1-2-3*, *Microsoft Word*, and *WordPerfect* began shipping. Even some significant Presentation Manager applications (Aldus's *PageMaker*, *Microsoft Excel*, *Micrografx Designer*, and *AutoCAD*) either shipped or are expected shortly.

Coming quickly on the heels of OS/2 1.2 is a new version of *Microsoft Windows*, Microsoft's graphical user interface (GUI) for DOS and Presentation Manager's little brother. *Windows* 3.0 is a significant upgrade that allows *Windows* applications to run in 286 protected mode under DOS and to access up to 16MB of physical memory. *Windows* 3.0 also has an enhanced shell very much like the new Presentation Manager shell. Users of the DOS-based *Windows* environment and the OS/2 Presentation Manager will thus experience nearly identical graphical user interfaces and will have a smooth transition from one to the other.

Windows 3.0 is so good that some pundits are even suggesting that it will eliminate the need for OS/2! Still to come, however, is OS/2 2.0. Expected sometime in 1990, OS/2 2.0 will offer real 386 support, including 32-bit registers and addressing, and the ability to multitask existing DOS applications. At that time, no other personal computer operating system will come close to OS/2 in power and functionality.

Except Unix, of course. Despite its inability to move out of the university and engineering ghettos into the corporate world, Unix is picking up significant enhancements that make it more palatable to the common user.

What Unix needs most is a friendly GUI. The only problem is: Which one? AT&T and Sun proposed *Open Look*, running on X-Windows and Sun Microsystems' *NeWS*. The Open Software Foundation proposed *OSF/Motif*, which incorporates the Presentation Manager look and feel on top of X-Windows. Microsoft and Hewlett-Packard are working on *PM/X*, a Unix version of the Presentation Manager application program interface. Steve Jobs unveiled the NeXT machine, with a GUI known as *NeXTStep* running on Mach, a Unix-compatible operating system. NeXT then licensed the software to IBM, apparently for porting to AIX, IBM's Unix compatible. How all this will shake out is anyone's guess.

As more OS/2 applications become available, corporate computing in the first few years of the 1990s is likely to shift from DOS to OS/2 2.0 running on 386 machines. The Apple Macintosh and Commodore Amiga have carved out seemingly impenetrable niches in some segments of the business world, but the OS/2 Presentation Manager may invade those niches. If the Unix folks ever get their act together, Unix could offer some competition to OS/2. But I wouldn't put any money on it.

The rarity in the 1990s will be a PC without a GUI. That's where the user will benefit, regardless of who wins the operating system wars. ■

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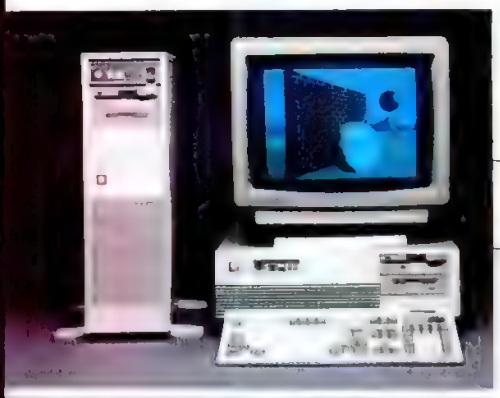

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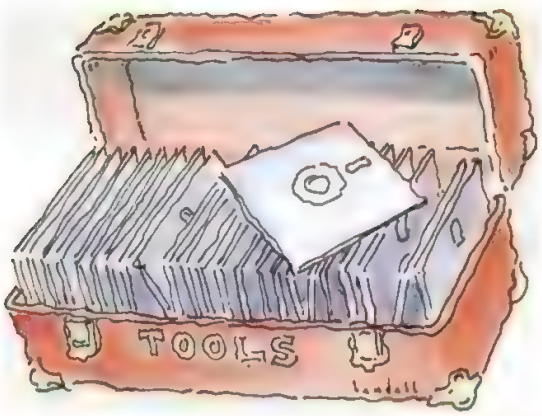

PC Tools Deluxe: jack of all utilities.

and a communications module. All of these applications run in windows—a clipboard allows quick transfers of data among them—and you can keep the desktop resident in memory for instant access from any other application. That is, if the applications that come in the package aren't enough to keep you busy by themselves.

PC Tools Deluxe's disk utilities, which can be run from the desktop or on their own, include a fast and reliable backup program, a cache, a defragmenter, an encryption program powerful enough to keep the package from being exported, and a full-scale file manager with *Lotus 1-2-3* and *dBASE* file viewers. If a file you want to manage doesn't appear on the directory because you deleted it, the undeleter can bring it back. The utilities, like the desktop, can be run as a TSR.

PC Tools is the first integrated desktop and utility package that's powerful enough for advanced users and simple enough for beginners. You can buy standalone utilities that perform all the functions in *PC Tools Deluxe* with a bit more finesse, but the total cost would be perhaps twenty times as much.

FACT FILE: *PC Tools Deluxe*, Version 5.5; Central Point Software, 15220 NW Greenbriar Pkwy., #200, Beaverton, OR 97006; (503) 690-8090. **List Price:** $129. **Requires:** 512K RAM, DOS 3.0 or later. **Reviewed:** October 17, 1989, page 51.

CIRCLE 543 ON READER SERVICE CARD

PUBLISHING TECHNOLOGIES INC

PubTech File Organizer, Version 2.10a

by Frederic E. Davis

PubTech File Organizer, a $200 *Microsoft Windows* add-on package, gives your PC the look and feel of a Macintosh and makes it almost as easy to use. Like *Command Post*, *PubTech File Organizer* replaces *Windows*' MS-DOS Executive with a graphics-based system for manipulating files and programs. *PubTech File Organizer* looks almost identical to the Macintosh operating system, with icons, file folders, and even a trash can. Like the Mac, the program uses icons to represent programs, data files, printers, and disk drives. A file folder icon is used to represent a subdirectory; programs, documents, worksheets, graphics, and other files appear as various icons within a window that represent the contents of the folder. Files can be moved from one directory or volume to another by using the mouse to drag the appropriate icon from the source directory to the target directory. You can move individual files or groups, and you can copy whole subdirectories, including nested subdirectories, from one directory to another on the same or on a different disk. There are special icons for 5.25-inch disk drives, 3.5-inch disk drives, hard disks, and remote volumes located on a network file server.

One of *PubTech*'s benefits, not yet provided by the Macintosh, is the ability to view a volume's subdirectories in a hierarchical tree-style format; this makes directory management a snap. To facilitate printing, the *PubTech* system creates an icon representing an installed printer. This is based on an object-oriented metaphor that allows you to print files by using the mouse to place the documents you want printed above the printer icon. The program also lets you create custom menu items for running applications (or .BAT files) by selecting them from a menu or by invoking them with keystroke combinations that you define.

PubTech is a large and plodding package, but Publishing Technologies is continuing to improve it. The company has versions for *Windows* 3.0 and the Presentation Manager in the works as well.

The *PubTech File Organizer* may be an imitation, but it's a good imitation. Add it to *Windows* and a low-priced 286 or 386SX computer and you will have a "poor man's Macintosh." And having a way to make a PC behave like a Mac can be quite useful if you need to support people who use both PCs and Macs. Even if you

don't give a hoot about the Mac, *PubTech* sure makes DOS file management a lot easier.

FACT FILE: *PubTech File Organizer*, Version 2.10a; Publishing Technologies Inc., 7719 Wood Hollow Dr., #260, Austin, TX 78731; (800) PUB-TECH, (512) 346-2835. **List Price:** $200. **Requires:** 512K RAM, DOS 3.1 or later, *Microsoft Windows* 2.03 or later. Mouse recommended. **Reviewed:** December 13, 1988, page 46.

CIRCLE 602 ON READER SERVICE CARD

INTUIT SOFTWARE

Quicken, Version 3.0

by Bill Howard

It started out five years ago as a check-writing program, no more, no less. *Quicken* 3.0 has evolved into a personal-finance manager and even a passable small-business accounting tool. Oh, yes—it still writes checks, and quite

PC MAGAZINE EDITORS' CHOICE June 13, 1989

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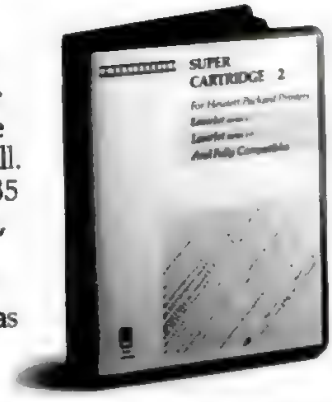

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well, thank you.

The current version allows you to allocate the costs of any check or transaction into 30 categories—for instance, the components of your Visa bill—and you can transfer money among multiple accounts. Write a $2,000 money market check to refill your personal checking account, then type the word [CHECKING] on the memo line, and an offsetting transaction appears automatically. Or if you think all this accounting mumbo jumbo is too much of a hassle, you can just write your checks, print them on *Quicken* checks, stuff them in envelopes, and be on your way in no more time than you'd probably spend writing typical paper checks. *Quicken*'s only major drawback is that it lacks a seamless link to an electronic bill-paying service. It has a klunky link now; a better one is promised.

Even as it's grown more capable, *Quicken* hasn't lost sight of the fact that paying bills is a hassle and that no program will make it fun, so your best bet is to make it fast. *Quicken* does that well, and if you want to use the enhanced reporting features, you can keep track of your family, small-business, or Schedule C (personal small business) expenses in as much detail as you care to.

FACT FILE: *Quicken*, Version 3.0; Intuit Software, 540 University Ave., Palo Alto, CA 94301; (415) 322-0573. **List Price:** $59.95; upgrade from Version 2.0, $29.95; *Quicken* Transfer Utility, $19.95; *CheckFree*, $9 per month for 20 payments, $3 for every 10 additional payments. **Requirements:** 320K RAM, DOS 2.0 or later. **Reviewed:** September 26, 1989, page 46.

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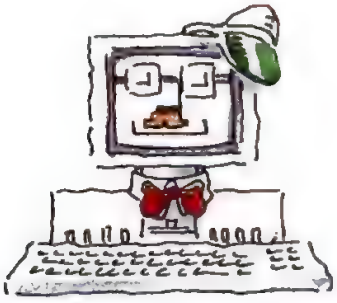

Quicken 3.0 can manage your personal finances, handle small-business accounting, and write your checks.

BORLAND INTERNATIONAL INC *Reflex*, Version 2.0

by Tony Rizzo

Reflex 2.0 is a fast, flat-file database manager boasting a crisp graphical user interface, multiple windows, mouse support, graphs, and super-efficient memory management. *Reflex* 2.0 is packed with all the features anyone could possibly want from a flat-file database system: cross-tabbing (an absolute necessity for analyzing data), powerful mail-merge and mailing-label and report generation that are a breeze, calculated fields and a large collection of functions to operate on the formulas in those fields, automatic support for expanded memory, and much more. It's a power-user tool for those of us lucky enough to own the necessary hardware.

And just what might that hardware configuration be? How about an EGA card, 640K of memory, and an 8088-based PC or compatible running DOS 3.3? You don't believe it, of course; this is hardly a power-user configuration. But it is the configuration of the machine I happen to be running *Reflex* 2.0 on at the moment, and it is precisely what earns *Reflex* 2.0 a "Best of" rating in my book. In fact, *Reflex* 2.0 will perform well on machines of less power than this! And it will fly on 286 machines.

While Borland's Applications group was busy developing the application, its Systems group was developing its new VROOMM (Virtual Real-time Object-Oriented Memory Manager) technology, a fancy name for a fresh approach to dynamic memory management under DOS, which makes it possible for *Reflex* 2.0 to control the allocation of memory to both program code and data in optimal, on-the-fly configurations. Even better news is that the user needs to know none of this. The user need only sit down and put *Reflex* 2.0's powerful resources to work on the problem at hand. Clearly it's one of the best products of 1989.

FACT FILE: *Reflex*, Version 2.0; Borland International Inc., 1800 Green Hills Rd., P.O. Box 660001, Scotts Valley, CA 95066; (408) 438-8400. **List Price:** $250. **Requires:** 512K RAM, graphics adapter, DOS 2.0 or later. **Reviewed:** August 1989, page 33.

CIRCLE 545 ON READER SERVICE CARD

PERSONICS CORP *SeeMORE*, Version 2

by Jim Seymour

When Personics rolled out the original version of its *Lotus 1-2-3* add-in, *SeeMORE*, a year and a half ago, *1-2-3* users wept with joy. We'd

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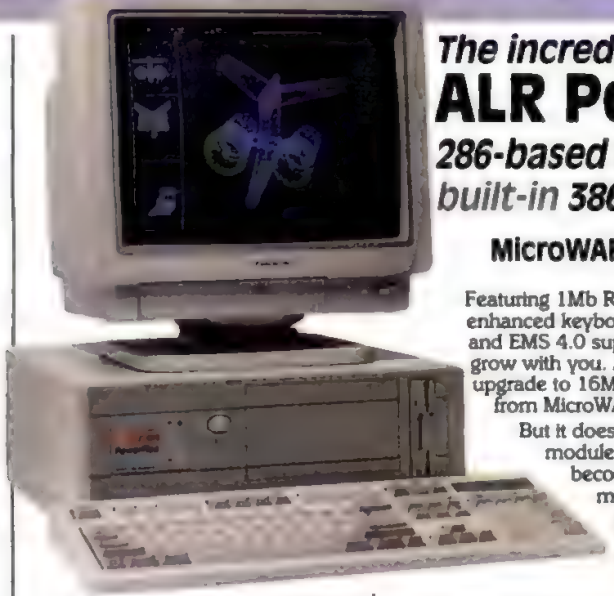

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grown so frustrated by the limitations of 80-character-wide displays that *SeeMORE*'s ability to put many more rows and columns on-screen seemed like nirvana.

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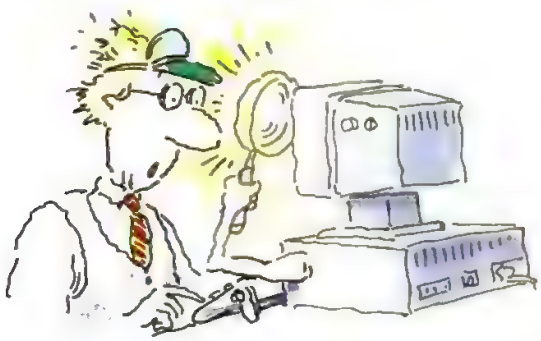

SeeMORE gives *Lotus 1-2-3* 3.0 a run for your money.

monitors—though that size is eye-poppingly small, so most users opt for the still-priceless 106 by 48 or 128 by 53 options.

This year a very good product got even better. The new version adds the ability to show larger type, at 40 by 34, for quick-and-dirty desktop presentations at your future business meetings. It lets you open multiple windows on-screen, so you can edit different parts of the worksheet at once. And best of all, it lets you stick a *1-2-3* graph in one of the windows, watching it change in real time as you fiddle with the numbers in the underlying worksheet.

And it delivers all that in *1-2-3*, Release 2.*x*. Take that, Release 3.0!

FACT FILE: *SeeMORE*, Version 2; Personics Corp., 63 Great Rd., Maynard, MA 01754; (508) 897-1575. **List Price:** $100. **Requires:** 80K RAM, *Lotus 1-2-3*, Release 2.0, 2.01, or 2.2; graphics adapter. **Reviewed:** August 1989, page 51.

CIRCLE 546 ON READER SERVICE CARD

SYSTEMS COMPATIBILITY CORP.
Software Bridge, Version 4.0

by Donald P. Willmott

The more complicated word processors become, the more difficult it is to move files between programs without losing all your tab spaces, underlining, footnotes, and page formats. Systems Compatibility Corp.'s $149 *Software Bridge* has long been the dominant force in word processor format conversion, and with good reason. Quite simply, it's faster and more accurate than any of its competitors. If your oft-used software includes more than one word processor, you shouldn't be without it.

Version 4.0 adds new features that increase both its functionality and its ease-of-use. The most interesting new feature is automatic file recognition and translation; the program can detect the type of word processor file format you want to convert. You don't need to know where the file came from, only where it's going. You can even change font selections during the conversion process.

Software Bridge translates 22 file formats automatically; new to Version 4.0 are the *PFS* series of products, IBM's *Writing Assistant*, and *Intelligent ASCII*. Crystal-clear pop-up menus make translation procedures fast and straightforward.

And don't forget *Software Bridge*'s best feature of all. It is absolutely, positively guaranteed to end the nasty feuds between the *Microsoft Word* and *WordPerfect* users in your office.

FACT FILE: *Software Bridge*, Version 4.0; Systems Compatibility Corp., 401 N. Wabash, #600, Chicago, IL 60611; (800) 333-1395, (312) 329-0700. **List Price:** $149. **Requires:** 384K RAM, two disk drives, DOS 2.0 or later. **Reviewed:** April 25, 1989, page 144.

CIRCLE 547 ON READER SERVICE CARD

PHAR LAP SOFTWARE INC.
386|DOS-Extender and 386|VMM Virtual Memory Manager, Version 2.2b

by Craig Stinson

Most of the users of Phar Lap's *386|DOS-Extender* and *386|VMM Virtual Memory Manager* don't even know that these exist. But those two outstanding products from Phar Lap are key components in many important 80386 applications, including Interleaf's *Publisher*, Borland International's *Paradox/386*, and Wolfram's *Mathematica*. Phar Lap has also been instrumental in the creation of the Virtual Control Program Interface (VCPI) Standard, which allows 80386-specific applications and control programs to cooperate and share extended memory. In my book, the folks at Phar Lap are the unsung heroes of this confusing and protracted period of slow transition to 32-bit PCs.

The Phar Lap *386|DOS-Extender* provides a protected-mode environment on top of MS-DOS, allowing an application program to take full advantage of the 80386's 32-bit registers, 4-gigabyte physical address space, and

GET SMART: High-Performance Caching Disk Controllers

by Catherine D. Miller

There's a new breed of high-performance hard disk controllers—a group of add-in mavericks that can propel your 286 or 386 hard disk to unexpectedly high speeds. *PC Magazine* first came across this group during the testing process for the May 30, 1989, issue devoted to 386 computers. Konan Corp.'s TenTime and Distributed Processing Technology's SmartCache controllers turned in blazing times on the PC Labs disk performance tests.

The methods these controllers use to attain such speeds vary. Some employ buffering schemes with small read-ahead caches. Western Digital Corp.'s WD1007A ESDI controller with a 16K RAM read-ahead cache and Adaptec's ACB-237XC RLL controller with an 8K RAM read-ahead cache are two examples. When an application program requests data from disk, these controllers read sequential disk data, beyond the data you request, into the buffer.

By reading data into high-speed RAM, these buffering schemes reduce disk access time and increase data throughput. If an application program requests data that is in the controller's cache, it's transferred from the cache to the system, eliminating time-consuming disk access.

There is a significant difference between controller buffering schemes and the caching schemes of disk controllers from Konan, DPT, and CompuAdd: intelligence. Caching controllers maintain lists of discontiguous blocks of disk data as they are requested and keep the data in the cache. The caching algorithm employed by each caching controller determines which data to keep or discard from the cache.

DPT's $1,150 SmartCache comes standard with 512K RAM, expandable to 16MB, in 2MB increments. A daughterboard to control one floppy disk costs $80. A 68000 microprocessor allows the controller to access the disk drive while the computer simultaneously reads or writes to the cache. Disk read-ahead, write-back, and elevator sorting further increase performance. (Elevator sorting allows sequential writing of cache data back to the disk.) SmartCache uses the existing system BIOS. Models for ESDI, RLL, and MFM drives are available.

Konan's TenTime Controller, $695 for MFM drives and $745 for RLL drives, includes 128K of dual-ported RAM and a floppy disk controller. It uses a Z-80 microprocessor for simultaneous disk and cache access, and a lithium battery supports its nonvolatile read-through/write-through cache. Elevator sorts and disk read-ahead maximize performance. TenTime uses its own BIOS.

The HardCache/ESDI controller from CompuAdd costs $495 and has a 256K cache, expandable to 4MB. It uses a read-ahead algorithm and relies on a least recently used (LRU) algorithm to replace data in the cache with new data. The cache is broken up into localities, so data coming from different applications is mapped into different areas of the cache. A 10-MHz 80188 microprocessor allows simultaneous cache reads and writes. The HardCache/ESDI uses its own BIOS.

Are the performance increases worth the overhead carried by each of these caching schemes? Preliminary PC Labs disk performance testing on an 8-MHz IBM AT showed that the benefits may well be worth it. Our disk benchmark tests read and write 256K files using either 512-byte, 4K, 8K, or 16K records. These operations are performed both randomly and sequentially. Generally, we found that the size of the cache must be about two to four times the file size to get optimum performance from these controllers. Once the cache is larger than that, it has no additional impact on performance.

With a 4MB cache, CompuAdd's random and sequential read times were generally faster than DPT's ESDI SmartCache with a 4.5MB cache, while DPT's write times were faster. CompuAdd and DPT both achieved a 65 to 85 percent increase in performance over Western Digital's WD1007A buffering ESDI controller in nearly every test. When the cache was four times the file size, Konan and DPT both showed a 71 to 83 percent increase in performance over the standard IBM AT ST-506/MFM controller.

To determine which controller will best eliminate your PC's disk-accessing bottleneck, ask yourself which application you use most. How that application accesses data will influence your choice.

For applications that read and write large blocks of sequential data, buffering may increase performance as much as caching controllers do. But caching controllers can be a real boon for extremely fragmented disks, or for applications that access the same data repeatedly or use data distributed randomly all over the disk. Multiuser, multitasking, graphically oriented, database, and other disk-intensive applications can all reap the performance benefits available from today's crowd of caching controllers. ■

DPT SmartCache Disk Controller; Distributed Processing Technology, 132 Candace Dr., Maitland, FL 32751; (407) 830-5522. **List Price:** 512K RAM ST-506, RLL, or ESDI controller, $1,150; floppy daughterboard, $80; 2MB SmartCache Expansion Board, $970; 4MB SmartCache Expansion Board, $1,695; 4MB SmartCache Memory Module, $1,695. **Requires:** 80286- or 80386-based PC.

CIRCLE 605 ON READER SERVICE CARD

HardCache/ESDI; CompuAdd Corp., 12303 Technology Blvd., Austin, TX 78727; (800) 627-1967. **List Price:** With 256K RAM, $495; with 1MB RAM, $740; each additional 256K SIMM, $95; each additional 1MB SIMM, $340. **Requires:** 80286- or 80386-based PC, DOS 3.2 or later or OS/2 1.1.

CIRCLE 606 ON READER SERVICE CARD

TenTime; Konan Corp., 1829 W. Drake Dr., #103, Tempe, AZ 85283; (602) 345-1300. **List Price:** MFM hard disk caching controller, $595; RLL hard disk caching controller, $645; MFM and RLL floppy upgrades, $100 each. **Requires:** 80286- or 80386-based PC, ST-506 hard disk.

CIRCLE 607 ON READER SERVICE CARD

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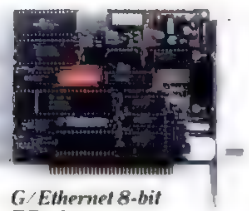

G/Ethernet 8-bit PC adapter

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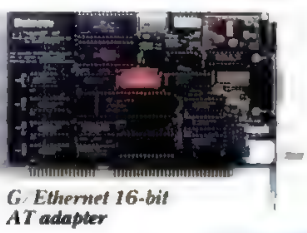

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enhanced instruction set. When the application requests file services, console I/O, or other MS-DOS services, *386|DOS-Extender* switches the CPU into real mode and relays the function call to MS-DOS. After the request has been satisfied, *386|DOS-Extender* puts the CPU back into protected mode and returns control to the application.

The *386|VMM Virtual Memory Manager* may be used with *386|DOS-Extender* to provide 80386 application programs with true virtual memory capabilities (demand paging). The amount

of memory that can be allocated by the program for executable code and data is limited only by the amount of installed physical memory, plus the amount of free disk space available for swapping.

While OS/2 and Unix have been battling for future 80386 market share—and hogging the headlines—Phar Lap has been quietly shipping high-quality tools that allow software developers to build and sell 80386-specific applications today. Phar Lap's products are robust and reliable, the documentation is excellent, the technical support is exemplary, and the updates are frequent and inexpensive. What more could a software developer ask for?

FACT FILE: *386|DOS-Extender* and *386|VMM Virtual Memory Manager*, Version 2.2b; Phar Lap Software Inc., 60 Aberdeen Ave., Cambridge, MA 02138; (617) 661-1510. **List Price:** *386|ASM/LINK* (with *386|ASM, 386|LINK, 386|DOS-Extender, MiniBug*), $495; *386|VMM*, $295. Runtime license fees vary. **Requires:** 512K RAM, 80386-based PC, DOS 3.0 or later. **Reviewed:** Not previously reviewed in *PC Magazine*.

CIRCLE 544 ON READER SERVICE CARD

QMS INC

UltraScript PC

by Alfred Poor

Are you among the millions who suffer with the double whammy of a tight budget and PostScript envy? Do you want the flexibility of scalable fonts, great graphics, and the ability to do all those nifty tricks with text, but you can't justify spending thousands to replace a working printer?

Call on *UltraScript PC*, the $195 program from QMS. This disk-based, PostScript-compatible interpreter might well be the answer to your problem. It comes with 25 typefaces; *UltraScript PC Plus* adds another 22 typefaces. QMS also plans to release an upgraded version that will add support for color printers.

UltraScript has two advantages over its competitors: ease-of-use and performance. Since it can "steal" data headed for your printer, you can use it within almost any application without the hassle of printing to disk first, then processing it in a batch mode. As long as your application does not try to write directly to the hardware, you can address *UltraScript* as if it were a standard printer port.

And the performance is outstanding. In PC Labs tests

with an HP LaserJet Series II, *UltraScript* was about average for its class in straight text, but it blew the doors off the competition in graphics. It was even faster than an Apple IINTX laser printer.

There are only two major requirements for *UltraScript*. If you are using a laser printer, you will need at least 1MB of memory. And no matter what printer you use, you will want to use at least 1MB of extended memory; without the extra RAM, *UltraScript* slows to a crawl.

So if you're looking to satisfy your craving for PostScript without breaking the bank, check out *UltraScript*.

FACT FILE: *UltraScript PC*; QMS Inc., 2650 San Tomas Expressway, Santa Clara, CA 95051; (800) 635-3997, (408) 986-9400. **List Price:** $195; *UltraScript PC Plus*, $445; 22 additional typefaces, $295. **Requires:** 80286- or 80386-based PC; 640K RAM; 800K extended memory; 4MB available hard disk space; HP LaserJet with 1MB RAM, HP DeskJet, Canon Bubble-Jet, Epson LQ, Epson Graphics, Epson FX printer, IBM Proprinter or compatible printer; DOS 3.10 or later. **Reviewed:** September 26, 1989, page 38.

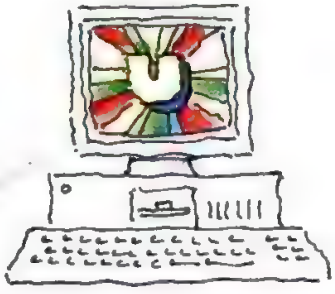
CIRCLE 549 ON READER SERVICE CARD

PERSONICS CORP.

UltraVision

by Lori Grunin

An ingenious combination of software and hardware, UltraVision fools a host of applications into thinking that



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All capacities approximated. *Represents average data compression performance of 2.25:1.

TECMAR

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CIRCLE 384 ON READER SERVICE CARD

you've got a VGA card and display installed. UltraVision is a small circuit card that plugs into the rarely-used feature connector of your EGA board. It doesn't add magical capabilities to your

EGA card; it just brilliantly harnesses the card's previously untapped potential.

For the relative pittance of $120, you get higher-resolution *Microsoft Windows*, *AutoCAD*, *Lotus 1-2-3*—the list goes on. People who use only text-based applications benefit as well; the software replaces the 8 by 8 EGA characters with more-graceful 9 by 16 ones, and gives you the choice of 17 screen fonts ranging from the system font to Old English.

UltraVision also puts the whole 64-color palette at your fingertips, enabling you to choose and save different subsets of 16 colors for use with your applications. In addition (depending on your graphics card), UltraVision can set different screen sizes, from 40 columns by 25 lines to 132 columns by 43 lines.

And unlike the situation with many other display utilities, all of these attributes *stick* as you jump from one application to the next.

If you're using an EGA monitor but not running UltraVision, you *deserve* to be staring at squat characters, seeing fewer rows of your spreadsheet, and subjecting yourself to DOS's dubious taste in screen colors. ■

FACT FILE: UltraVision; Personics Corp., 63 Great Rd., Maynard, MA 01754; (508) 897-1575. **List Price:** $120. **Requires:** 18K RAM, EGA graphics adapter, DOS 2.0 or later. **Reviewed:** January 17, 1989, page 56.

CIRCLE 550 ON READER SERVICE CARD

THE BEST OF 1989 CONTRIBUTORS

***PC Magazine* editors:** Bill Machrone, editor-in-chief and publishing director; John Dickinson, Bill Howard, and Gus Venditto, executive editors; Frank J. Derfler, Jr., workgroup systems editor; Tony Rizzo, senior technical editor; Mary Kathleen Flynn, Jonathan Matzkin, and Donald P. Willmott, associate editors; Catherine D. Miller, staff writer; Stephanie K. Losee, Rock Miller, and Jennifer Zaino, staff editors; Lori Grunin, assistant editor; Frederic E. Davis, director of PC Labs; Robert W. Kane, PC Labs project leader.

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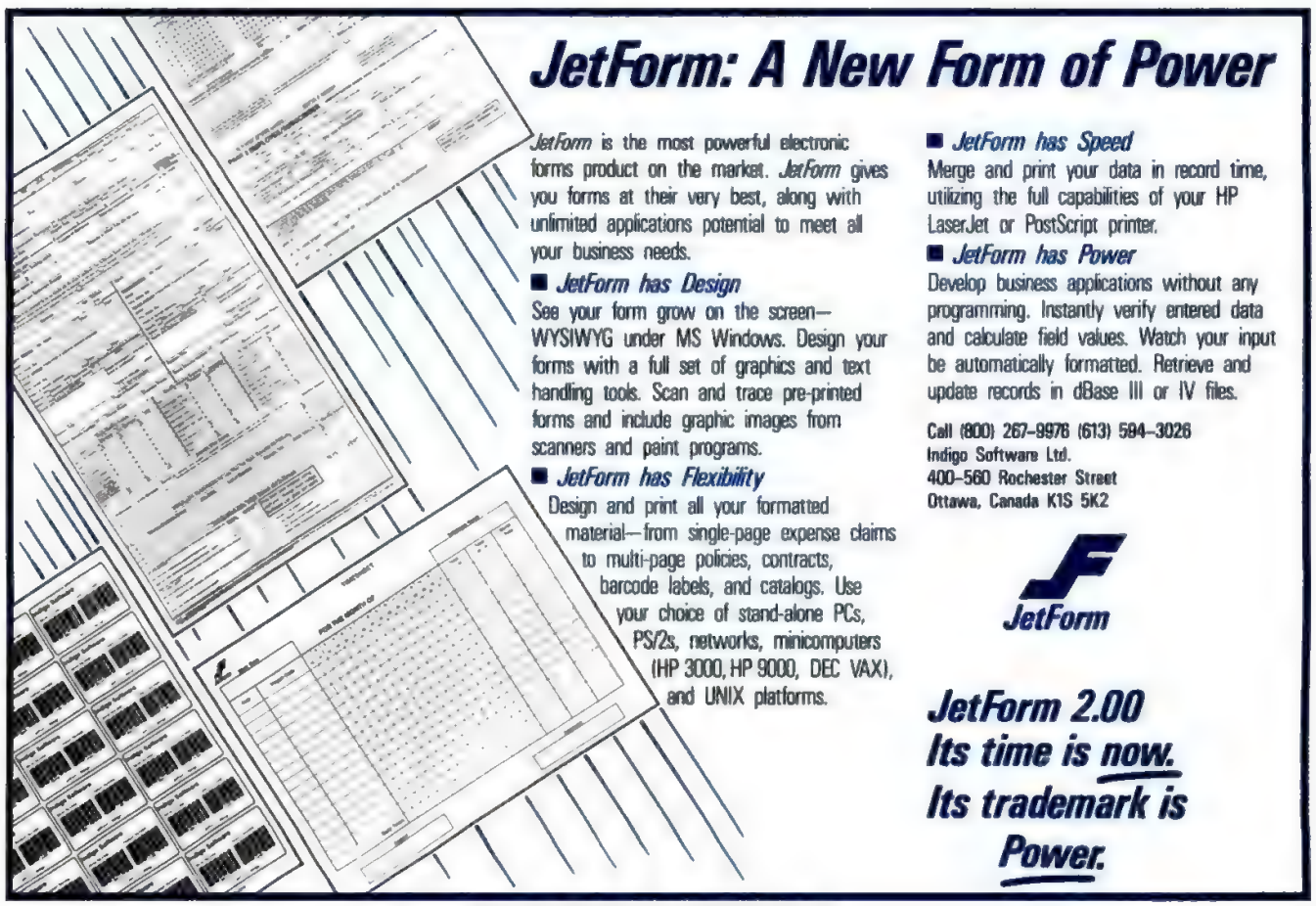
Frequent contributors: Mitt Jones, Barry Simon, Craig Stinson. ■



CIRCLE 257 ON READER SERVICE CARD

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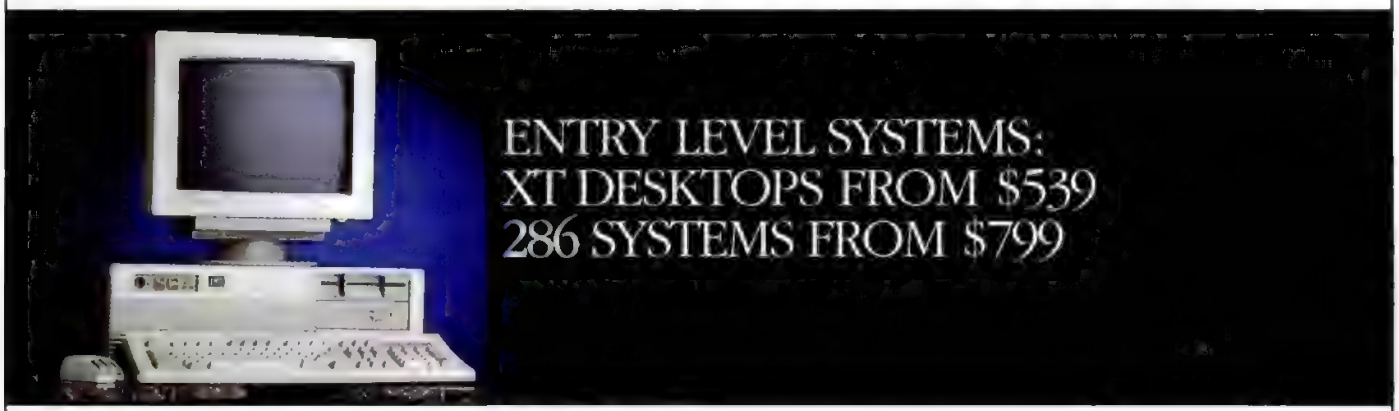

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PC BRAND 286/20 _____ $999

20 MHz Clock, Zero Wait Operation
Norton SI 23.0 Landmark™ 26.7MHz
512K RAM, 1.2MB or 1.44MB Drive, 101-Keyboard

Standard System Features:

- 80286-12 or 80286-20 operating at 12 MHz or 20MHz w/Zero Wait States delivering 15.3MHz or 26.7MHz Effective Throughput
- 512K RAM expandable to 8MB on the System board using 256K or 1MB 100ns RAM
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- High performance 16bit VGA Cards on all VGA Systems w/1024 x 768 capability
- 1:1 Interleaving Drive/Floppy Drive Controller
- Enhanced 101-key AT Style Keyboard
- High Capacity System Power supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 Co-Processor Support
- AMI BIOS w/ full MS/DOS, OS/2, XENIX, UNIX, NOVELL, 3COM and PCNET compatibility
- Built-in System Board LIM 4.0EMS hardware
- User configurable I/O timing permitting compatible operation w/older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (5 16Bit & 3 8Bit)
- Medium foot print case w/5 Disk Drive bays

Options:

- Low profile Slim Line Case
- Mini Size desk top Tower ® Case
  (see photo on next page)
- LCD or Plasma Portable
- Factory Installed RAM Upgrades
- Custom configurations w/Name Brand peripherals of your choice

PCV20 AD-II

w/512k Hard Disk Drive, Monitor & Video Card

Hard Drives	No Video	Mono	VGA/Mono	VGA/color
1 Floppy	$539	$664	$824	$1054
2 Floppy	$624	$739	$899	$1129
40MB-45MS	$844	$914	$1104	$1334
66MB-25MS	$994	$1094	$1254	$1484

PC BRAND 286/12

w/ 512k Hard Disk Drive, Monitor & Video Card

Hard Drives	No Video	Mono	VGA/Mono	VGA/color
40MB-45MS	$1107	$1207	$1402	$1637
66MB-25MS	$1332	$1432	$1627	$1862
71MB-18MS	$1472	$1572	$1767	$2002
110MB-25MS	$1572	$1672	$1867	$2102

PC BRAND 286/20

w/512k Hard Disk Drive, Monitor & Video Card

Hard Drives	No Video	Mono	VGA/Mono	VGA/color
40MB-45MS	$1307	$1407	$1602	$1837
66MB-25MS	$1532	$1642	$1827	$2062
71MB-18MS	$1637	$1737	$1932	$2167
110MB-25MS	$1762	$1862	$2057	$2292
150MB-17MS	$2257	$2357	$2552	$2787 ESDI
320MB-16MS	$2717	$2817	$3012	$3247 ESDI

CIRCLE 303 ON READER SERVICE CARD

Intel 386 Technology at 286 Prices the 386 SX-16 Only $1089

30-DAY MONEY BACK GUARANTEE, FREE FREIGHT, TOLL-FREE SERVICE AND SUPPORT ON-SITE SERVICE 24 or 36 MONTH LEASING AND A 5-YEAR WARRANTY

"The PC Brand 386/SX-16 performed at least as well as the far costlier Compaq... We simply began marveling at what is surely the biggest bargain in personal computing"

-Computer Buyer's Guide, Cover Story, Dec. 1989

PC BRAND 386/SX-16 __ $1089

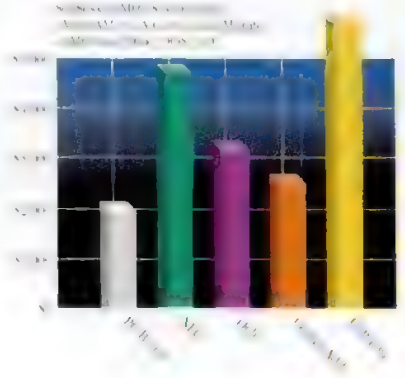
16 MHz Clock, Zero Wait Operation • Norton SI-18.7 Landmark™ 18.3MHz 512K RAM, 1.2MB or 1.44MB Drive, 101 Keyboard

Standard System Features:

- 80386SX Processor Operating at 16MHz delivering 18MHz Effective Throughput
- 512K RAM expandable to 8MB on the system board using 256K and/or 1MB RAM
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- High performance 16bit VGA Cards on all VGA systems w/ 1024 x 768 capability
- 1:1 Interleaving Dual Hard Drive/Floppy Drive controller
- Enhanced 101 key AT Style Keyboard
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80387SX Co-Processor Support
- AMI BIOS with full MS-DOS, OS/2, XENIX, UNIX, NOVELL, 3COM compatibility
- 8 Slot motherboard design (5 16Bit & 3 8Bit)
- Medium Foot print case w/ 5 Disk Drive bays (Shown w/ optional Mini Size Tower Case)

Options:

- Low profile Slim Line Case
- Mini Size desk top/Tower Case
- 16 Door Plasma Portable
- Factory Installed RAM Upgrades
- Custom configurations w/ Name Brand peripherals of your choice



PC BRAND 386/SX-16

w/ 512k Hard Disk Drive, Monitor & Video Card

Hard Drives	No Video	Mono	VGA Mono	VGA Color
40MB 45MS	$1407	$1507	$1702	$1957
60MB 28MS	$1632	$1732	$1927	$2162
74MB 18MS	$1757	$1857	$2032	$2267
110MB 28MS	$1862	$1962	$2157	$2392
150MB 17MS	$2087	$2187	$2382	$2687 FSDI
320MB 16MS	$2817	$2917	$3112	$3547 FSDI

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CIRCLE 308 ON READER SERVICE CARD

PC BRAND'S
386/20
386/25...

"FASTER THAN A SPEEDING BULLET!"

-Computer Shopper, Cover Story
November, 1988

20MHz
FROM $1489

25MHz
FROM $1689

"The Best Low-Cost Alternative Around!"

-PC Magazine, 25MHz 386 PC's, Feb. 14, 1989

PC BRAND 386/20 _____ $1489

20 MHz Clock, Zero Wait Operation
Norton SI 23.0 Landmark Speed 26.1MHz
1024K RAM, 1.2MB or 1.44MB Drive, 101 Keyboard

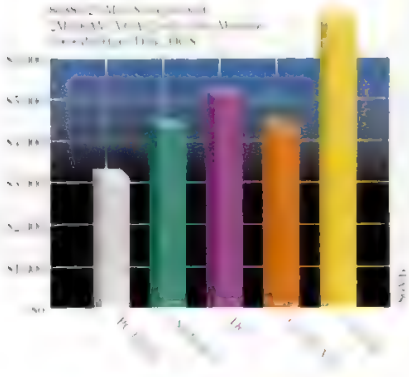
PC BRAND 386/25 _____ $1689

25 MHz Clock, Zero Wait Operation
Norton SI 28.2 Landmark Speed 33.6MHz
Norton SI 31.6 Landmark Speed 43.5 w/ Cache
1024K RAM, 1.2MB or 1.44MB Drive, 101-Keyboard

"The PC Brand 386/25 is a fascinating machine. It offers flexible configuration...at a bargain price..."

"and the company backs it all with what may be the longest warranty on the market...PC Brand makes it possible to buy two complete sytems for less than most competitors charge for just one."

- PC Magazine, 25MHz 386 PC's Feb. 14, 1989



Standard System Features:

- True 20MHz or 25MHZ Intel 80386 CPU Operating with Zero Wait States
- 1024K RAM standard, expandable to 16MB using 256K and or 1MB RAM
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- High performance 16bit VGA Cards on all VGA systems w/ 1024X768 capability
- 1:1 Interleaving Dual Hard Drive/Floppy Drive controller (977 o/s) KB SEC Caching Controller w/ ESDI Configurations
- Enhanced 101 key AT Style Keyboard
- High Capacity 200Watt System Power Supply
- Real Time Clock, Calendar with 5 Year Battery
- 80287, 80387 or Weitek Co-Processor Support
- AMI BIOS with full MS/DOS, OS/2, XENIX, UNIX, NOVELL, 3COM compatibility
- 8 Slot motherboard design (5 16Bit & 3 8Bit)
- Medium foot print case w/ 5 Disk Drive bays

Options:

- Low profile Slim Line Case
- Full or Mini Size Tower Case
- LCD or VGA Plasma Portable Case
- 32k or 64k Cache upgrade (25Mhz only)
- Custom configurations w/ Name Brand peripherals of your choice

PC BRAND 386/20

with Hard Disk Drive, Monitor & Video Card

Hard Drives	No Video	Mono	VGA Mono	VGA color
40MB 45MS	$1805	$1905	$2175	$2475
60MB 28MS	$1995	$2095	$2275	$2475
71MB 28MS	$2125	$2225	$2395	$2595
115MB 28MS	$2245	$2345	$2505	$2705
150MB 17MS	$2795	$2895	$3135	$3245 ESDI
42MB 16MS	$3295	$3395	$3480	$3680 ESDI

PC BRAND 386/25

with Hard Disk Drive, Monitor & Video Card

Hard Drives	No Video	Mono	VGA Mono	VGA color
40MB 45MS	$2082	$2182	$2487	$2577
60MB 28MS	$2232	$2332	$2537	$2727
71MB 28MS	$2362	$2462	$2667	$2857
115MB 28MS	$2492	$2592	$2797	$2987
150MB 17MS	$3092	$3192	$3397	$3557 ESDI
42MB 16MS	$3312	$3412	$3617	$3807 ESDI

CIRCLE 309 ON READER SERVICE CARD

THE 386/33 CACHE PERFORMANCE WIZARD

ONLY $2799

386/33 CACHE _____ $2799

33 MHz Clock, Zero Wait Operation
Norton SI 45.9 • Landmark 58.7 MHz
1024k RAM, 1.2MB or 1.44MB Drive, 101 Keyboard

"Here's a price $2799... Must be stripped to nothing, Right? Wrong...You don't sacrifice quality for low price either. The PC Brand machines are an efficient combination of in-house engineering and top-notch off-the-shelf Parts."

-PC Magazine, 33MHz 386 PC's, October, 31, 1989

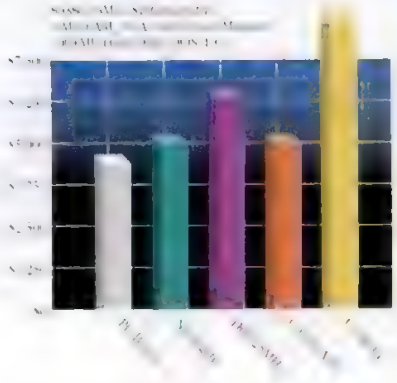
Simply put...We couldn't have said it any better ourselves!

Standard System Features:

- True 33 MHz INTEL 80386-33 CPU operating w/ Zero Wait States Delivering up to 58.7 MHz Effective Throughput
- Intel 82385-33 Cache Processor with 32K 25NS Static RAM Standard. Field Upgradable to 64K
- 1024k RAM Standard Expandable to 16MB
- High performance 16bit VGA Cards on all VGA systems w/ 1024 x 768 capability
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- 1:1 Interleaving Dual Hard Drive/Floppy Drive Controller, 977.6 KB/SEC Caching Controller w/ ESDI Configurations
- Enhanced 101-key AT Style Keyboard
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80387 or Weitek Co-Processor support
- Phoenix BIOS with Full MS-DOS, OS/2, XENIX, UNIX, NOVELL, ROM compatible
- 8 Slot motherboard design
- Full size case with 5 Disk Drive bays

Options:

- Full size Tower/8 Case (shown above)
- Custom configurations w/ Name Brand peripherals of your choice
- Factory Ram Upgrades



PC BRAND 386/33 CACHE

with Hard Disk Drive, Monitor & Video Card

Hard Drives	No Video	Mono	VGA Mono	VGA color
40MB 45MS	$1350	$1450	$1554	$1686
60MB 25MS	$1455	$1555	$1659	$1885
71MB 18MS	$1545	$1655	$1759	$1985
110MB 25MS	$1670	$1770	$1874	$2100
150MB 12MS	$1820	$1920	$2024	$2250
320MB 16MS	$1954	$2054	$2159	$2385

Turn the page for Portables & Peripherals

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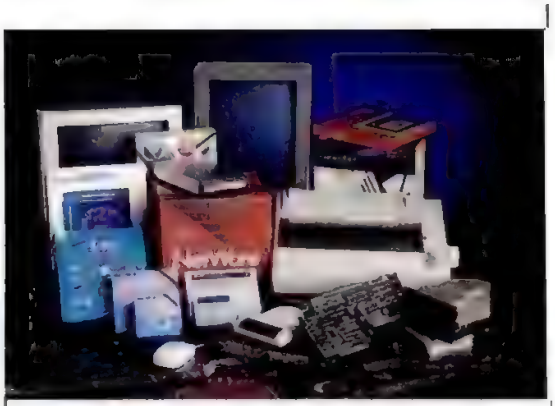
CIRCLE 304 ON READER SERVICE CARD

Portables with More Power than Desktops.



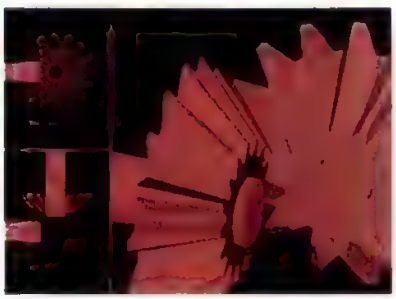
Backlit LCDs from $1745
VGA Plasmas from $2595

512K (286) or 1024K (386) RAM
Serial, Parallel, and Game Ports
1.2MB or 1.44MB Floppy, 86-Keyboard

The power, reliability and performance of our desktop system motherboards combine with our portable casing to make our systems technically unique!

We support 3 built-in, externally accessible disk drives, enabling dual (3.5" and 5.25") floppys for *True* in the field media compatibility, and tape, CD-ROM drives or other devices to deliver desktop functionality in a Portable Unit.

Simultaneous internal AND external monitor support, VGA functionality, 2 open card slots and our unique 3 drive support, permit this family to be used as a "Complete" in the office system which you can pick up and take home.



Actual VGA PLASMA Screen Image

Standard System Features:

- All performance and compatibility features as in desktop models featured on previous pages
- 3 Accessible Drive Bays for 2 5.25" & 1 3.5" Units
- 2 Available Peripheral Card Slots
- 16 Grey Scale 640x480 VGA Plasma or 4 Grey Scale 640x400 CGA/Mono Graphics Backlit Supertwist LCD Display
- Simultaneous internal and external display's
- 200Watt Auto Voltage Switching Power Supply

VGA Gas Plasma Portables

Drives	286/12	286/20	386/SX-16	386/20	386/25
1 Floppy	$2595	$2795	$2895	$3350	$3550
40MB 28Ms	$2995	$3195	$3295	$3750	$3950
60MB 28Ms	$3095	$3295	$3395	$3850	$4050
110MB 28Ms	$3395	$3595	$3695	$4150	$4350
150MB 17Ms	$3960	$4160	$4260	$4710	$4910 ESDI

LCD Backlit Portables

Drives	286/12	286/20	386/SX-16	386/20	386/25
1 Floppy	$1745	$1945	$2045	$2495	$2695
40MB 28Ms	$2145	$2345	$2445	$2895	$3095
60MB 28Ms	$2245	$2445	$2545	$2995	$3195
110MB 28Ms	$2545	$2745	$2845	$3295	$3495
150MB 17Ms	$3110	$3310	$3410	$3855	$4055 ESDI

CIRCLE 310 ON READER SERVICE CARD

Monitors*

Magnavox
7BM623 12" Amber Mono $79
CM8762 13" RGB Color (640x200) 230
CM9043 13" EGA Color (640x350) 339

Mitsubishi
1381 14" Diamond Scan VGA/EGA (to 800x600) $499
HL6605 16" VGA/EGA (to 1280x1024) 1295
HL6905 20" VGA/EGA (to 1280x1024) 2325

NEC
MultiSync GS-2A 14" Multi Mono (to 800x600) $249
MultiSync 2A 14" VGA (to 800x600) 499
MultiSync 3D 14" VGA/EGA (to 1024x768i) 649
MultiSync 4D 16" VGA/EGA (to 1024x768) 1150
MultiSync 5D 20" VGA/EGA (to 1280x1024) 2350

Panasonic
C1391 PanaSync 14" VGA/EGA (to 800x600) . $489
15"/19" 1280x960 Grey Scale Monitors ..... Call

Princeton Graphics
Max 15 14" Multifreq. Mono (to 1024x768 i) $249
UltraSync 14 14" VGA/EGA (to 800x600) 520
UltraSync 16 16" VGA/EGA (to 1024x768 i) 879

Princeton Publishing Labs
Multiview 15" Full Page w/adaptor (800x1000) $890

Relisys *(Top Rated by Infoworld and PC World)*
9503 14" VGA Mono (640x480) $135
9513 14" VGA (640x480) $369
1520 15" VGA/EGA Multifreq (to 1024x768) ..... Call

Seiko NEW!
1440 (to 1024x768 i) Call 1450 (to 1024x768) .... Call

Sony
1304 14" VGA (to 1024x768) $689

Zenith
ZCM-1490 14" Flatscreen VGA (640x480) $619

Modems

ATI
2400ETC Internal Modem w/ MNP5 ..... $165
2400ETC External Modem w/ MNP5 205

Hayes
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PC Brand *100% Hayes Compatible!*
1200 Internal (w/ Bitcom Software) $49
1200 External 70
2400 Internal (w/ Bitcom Software) 89
2400 External 129
2400 Internal w/ MNP5 NEW! ..... Call

US Robotics
Courier HST 14.400 ..... $599
Courier V.32 9600 External 889
Courier HST/V.32 Dual Standard Modem 995
Courier 300-9600 Internal NEW! ..... Call

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Digitizers, & Other Peripherals

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VGA Wonder w/ 512K (16 bit) 345
Paradise
EGA Autoswitch 480 W/256K $139
VGA+ w/ 256K (8 bit) 219
VGA+16 w/256K (16 Bit) 249
VGA Professional w/512K (to 800x600) 349
VGA Professional II w/512K (to 1024x768i) ..... Call
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Mono Graphics w/Printer Port $55
CGA Color Graphics w/Printer Port 49
EGA Autoswitch w/256K (8 bit) 99
VGA w/256K (8 bit) 159
VGA w/ 256K (16 bit). 195
Video Seven
1024i VGA w/ 256K (16 bit). $259
VRAM VGA w/256K , 512K (16 bit) ..... Call

Disk Drives

360K 5.25" HH Black $75
720K 3.5" HH Black w/5.25" Mounting 80
1.2MB 5.25" HH Grey 85
1.44MB 3.5" HH Grey w/5.25" Mounting 95
PS/2 Floppy Drives
CMS 5.25" 360K-PS/2 Ext Floppy $199
Hard Disk Drives:
Iomega
B120I Single 5.25" 20MB Int. w/o cntlr. $765
B144I Single 5.25" 44MB Int w/o cntlr. 995
B244X Dual 5.25" 44MB Ext w/o cntlr. 1995
Micropolis
330MB 18ms 1558-15 ESDI Full Hgt. $1550
640MB 2695
MicroScience
66MB 28ms HH 1060 RLL $419
116MB 28ms HH 1120 RLL 629
Miniscribe
71MB 18ms M3085 MFM $595
150MB 17ms M3180E ESDI 1/2 Hgt 1195
320MB 16ms M9380E ESDI Full Hgt. 1595
Priam
130MB 20ms ID130AT MFM Full Height $1395
160MB 28ms ID160EC ESDI w/CNTRL 1650
330MB 20ms ID330EC ESDI w/CNTRL 2250
Seagate
20MB 65ms ST225 w/XT Controller $249
20MB 35ms ST125 w/XT Controller 299
30MB 65ms ST238 w/XT Controller 269
30MB 35ms ST138R w/XT Controller 355
40MB 28ms ST251-1 MFM 349
40MB 24ms ST151 (voice coil, 3.5", in 5 1/4") 419
80MB 28ms ST4096 Full Height MFM 590
Toshiba
66MB 25MS MK134 RLL $429

Please Call For Other Models Not Listed and Ask About the New COMDEX Announcements

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40MB PC Brand for AT/XT Internal QIC-40 ..... $199
40/60MB Colorado Memory-Internal QIC-40 279
60MB Archive Int or Ext. w/Cntrl. 590
60MB Maynard Maynstream Portable 889
150MB Archive Internal/External 925/1250
150MB Maynard Maynstream Portable 1395

Printers*

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HL-8PS Postscript Editor's Choice ..... Call
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BJ130e Wide Cartridge, 360dpi, QUIET! ..... Call
LBP, LBP8-III Laser Printers w/Fonts ..... Call
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FX850 330/88 ..... 345 FX1050 264/54 445
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LQ950 264/88 ..... Call LQ2550 400/108 ..... Call
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150Plus 150/50 ..... 315 300WP 310/75 439
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Deskjet Plus ..... 710 Laserjet II 1720
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P2200XE 192/54 ..... 335 LC890 Laser 3190
Okidata
ML320 300/62 ..... 345 ML321 300/62 479
ML380 180/60 ..... 359 ML390 270/90 475
ML391 270/90 ..... 655 ML393 450/120 995
Panasonic *(New Models Listed)*
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Advanced Netware 286 (Ver. 2.15) 1850
SFT Netware 286 (Ver 2.15) 2850
Netware 386 ..... Call
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G/ Ethernet (8bit) 265
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PC130 Arcnet Board $135
PC270E Twisted Pair Arcnet Card 139
PC500-WS 16 Bit Work StationBoard 375
PC500-FS 16 Bit File Server Board 449
PC550-WS 16 Bit Twisted Pair Work Station Bd 395
PC550-FS 16 Bit Twisted Pair File Server Bd 495
PS110 Arcnet Board for PS/2 439
ARCNET passive/ Active Hubs ..... Call
Tiara
4 Port, 8 Port Hubs ..... Call
Lancard/A 8 Bit ARCNET Board 89
Lancard/E 8 Bit ETHERNET Board 199
Lancard/E 8 Bit Twisted Pair ETHERNET 329
Western Digital
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Ethercard+ A for PS/2 320

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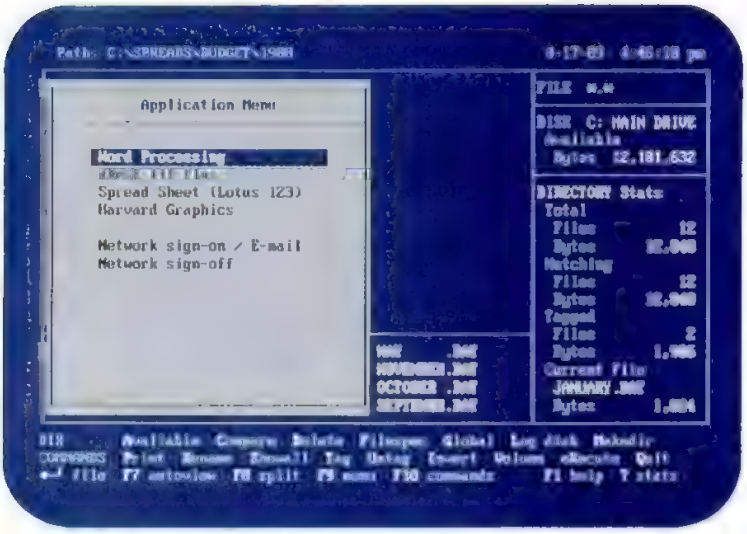
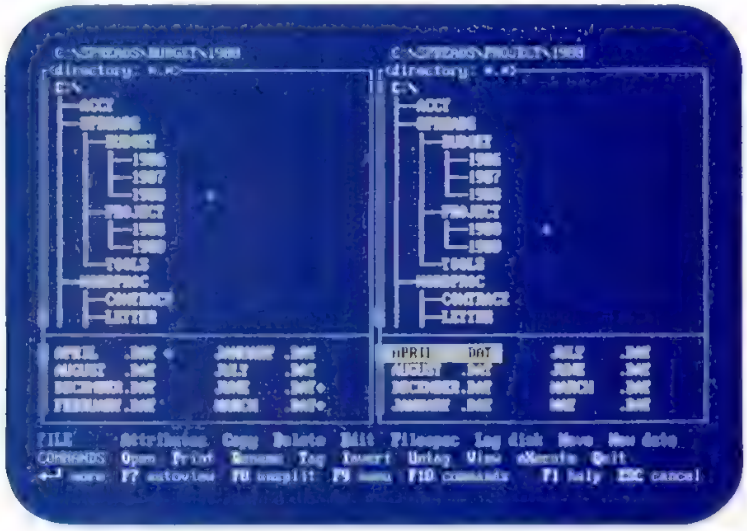
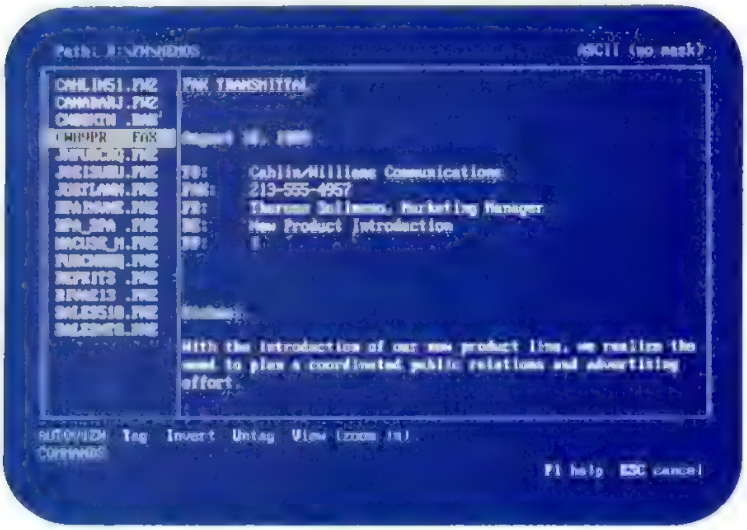
CIRCLE 311 ON READER SERVICE CARD



Application Menu—*Just point 'n shoot to run any application or commonly used procedure. MIS managers can easily create customized user environments.*



Split Windows—*Simultaneously view, compare and manipulate two separate directories or drives, and quickly locate files.*



AutoView—*Save time and guess-work by scrolling through file contents from the directory or file window.*

Disk management enters a golden age.

Discover XTreePro Gold. The most comprehensive file manager ever.

If you like the award-winning features of XTree and XTreePro, wait until you see the next generation....

XTreePro Gold goes beyond disk management to provide a complete hard disk user *environment.* With dozens of powerful new features that help you manage files, directories and disks more easily than ever before. And a streamlined DOS interface that eliminates cumbersome commands and automates repetitive operations.

With XTreePro Gold it's simple to view, extract, transfer and encrypt archived files. Search multiple files by contents. Execute applications and associated data files. Copy or move a block of text from one file to another. Even view the contents of files created by most popular word processing, dBASE and Lotus applications.

And XTreePro Gold was designed with the newest generation systems in mind, providing EGA/VGA graphics and integrated mouse support.

Whether you're a PC novice or guru, you'll soon find XTreePro Gold an indispensable productivity tool. If you already use a disk management product, you're even luckier: we'll upgrade users of any XTree Company software to XTreePro Gold for just $25.* And trade-in our competition for just $35.*† Call (805) 541-8102 or (416) 866-8592 in Canada for details. Or see your Authorized XTree dealer for a demo. And make the most of living in the golden age.

XTREE COMPANY

The world leader in disk management.

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by Bill Howard

Abort, Retry, Fail?

The Lighter Side of Personal Computing

SPECIAL EDITION

Elsewhere in this issue, *PC Magazine* honors the year's best and the technically excellent. Here we honor (well, take note of) the year's most memorable moments, people, products, press releases, and stories in a special eight-page edition of "Abort, Retry, Fail?"

So Bad They're (Almost) Good: Memorable Press Releases and Marketing Campaigns

"It's a far cry from filling [illegible]" is how Carol Drury describes the journey from her Staten Island bra and girdle shop to the IBM computer in the cabin of her 56-foot twin-screw motor yacht.

[illegible] press releases

"What's more powerful than a Mike Tyson punch, faster than Michael Jackson's legs, more needed than a cure for baldness, and more useful than disposable diapers? It's *Quicksilver* for UNIX, says WordTech Systems, a company renowned for its *dBASE* compilers."
—**WordTech Systems news release**

"Dear World Pork Expo '88 Visitor:
It has been over a year now since you visited our booth at the World Pork Expo '88 in Des Moines, Iowa. Our Pig Improver package, Version 2.0, was demonstrated at the World Pork Expo '89 in Springfield, Illinois, last month....
"As explained in the attached flyer, you may now buy 60 'test drives' of Pig Improver for $60.00. If after you 'test drive' the system, you decide not to keep Finalsoft, we will return the $60.00 to you."
—Finalsoft Corp. ("All Hog Farm Management Systems Are Not Created Equal") mailing. *PC Magazine* has no recollection of attending either World Pork Expo '88 or '89. And we think we would remember.

"**MEDIA ALERT**
NCR Corporation, with Microsoft Corporation and Kentucky Fried Chicken, will hold a news conference to unveil details of Kentucky Fried Chicken's new 'smart kitchen.' The personal computer driven kitchen, to be one of the largest OS/2 installations, will aid Kentucky Fried Chicken in its battle to win the fast-food wars."
—**Manning, Selvage & Lee press Mailgram**

Microsoft's two-millionth-mouse press release.

Ah for the Days When Only the News Was Stale

To cut through the clutter of press releases, PR types resort to ever more bizarre mailings. When one gimmick goes stale, the flacks move on to something new. Or different.

1988 was a year for Programmers' Breakfast press releases (Twinkies, Jolt Cola, press release) and Press-Conference-in-Your-Office packages (stale doughnut, coffee mug, pack of instant coffee, press release). 1989 has been heavy on glitter and sparkle, those little pieces of reflective confetti that fall all over your office and clothes when you open the envelope.

Another trend: the theme press release. To celebrate the production of two million mice (left), Microsoft sent editors boxes filled with stale popcorn, two cans of Coke, a bag of microwave popcorn, a videocassette of *The Mouse That Roared*, and, of course, a press release.

ADVERTISING

The year's best advertising: The Dell Computer campaign, created by Chiat-Day, says what users already know— In many cases, storefront dealers charge more and know less, so why not consider mail order? Dell's slick ads also helped raise the prestige of the mail-order (a.k.a. direct marketing) industry in general.

LEGAL BRIEFS

- NEC Home Electronics Ltd. says it owns the rights to the words "docking station."
- The Strategic Planning Institute of Cambridge, Massachusetts, says it owns the rights to the acronym PIMS because it sells a service called Profit Impact of Market Strategy and doesn't like computer magazines referring to Personal Information Managers as PIMs.
- Mead Corp.'s Lexis on-line legal database sued Toyota's Lexus cars division for name infringement. Toyota won.

MEDIA

The Media Explains the Computer Revolution In Terms We All Can Understand

Until You Unleash Its Power, Your Computer Is an Idiot . . .

"A computer doesn't think; it's more of a 'high-speed idiot' that uses complex sets of instructions—programs—to perform everyday business tasks. Your program loads into the computer's memory, where the microprocessor then pulls out specific chunks of instructions in response to your typed commands."
—Crutchfield Personal Office Catalog, Winter/Spring 1989

. . . Why, Even the Family Pet Has More Common Sense

"Your pet cat, dog, parakeet, or goldfish has more innate common sense than your computer will ever have. A computer has no consciousness whatsoever. Like your vacuum cleaner, digital watch, or record player, it is just another inanimate man-made object. It has no will. It does not think. It knows nothing. It wants nothing. It plans nothing. But when properly activated and properly used, it can serve as perhaps the most miraculous intellectual and creative tool ever devised by humans, capable of extending the capacity of your hands, eyes, ears, and mind phenomenally."
—*Computer Buyer's Guide*, Spring 1989

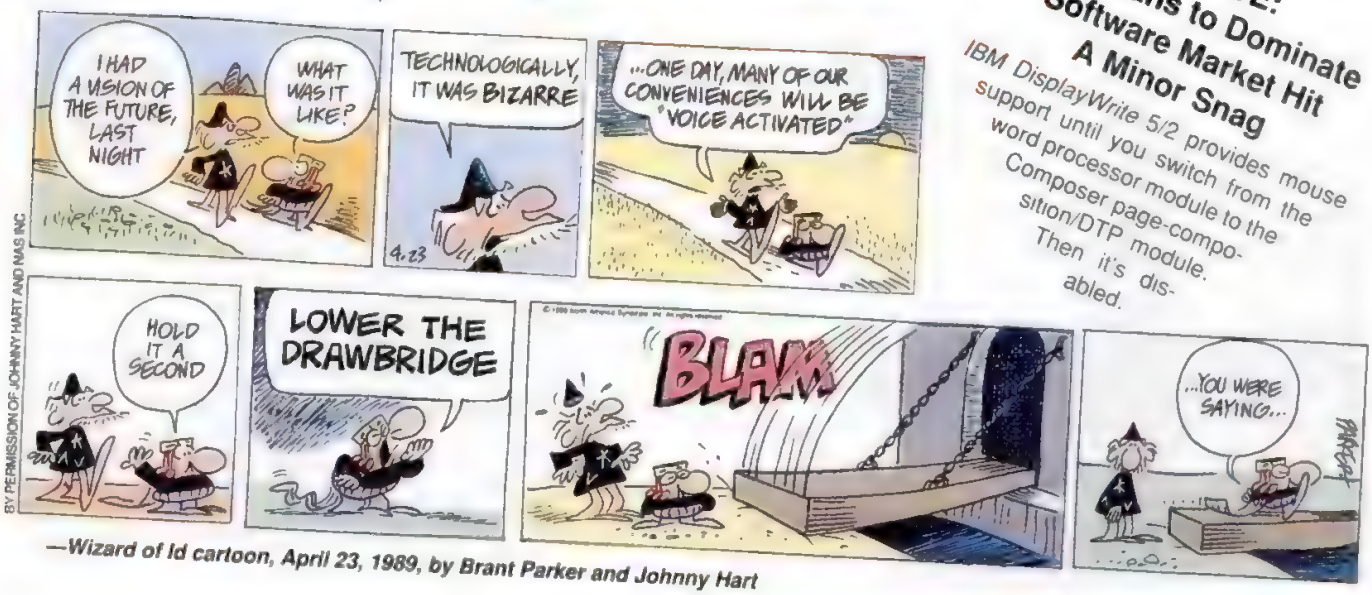
★ ★ ★ ★

A Smash! I Laughed! I Cried! Almost Peed in My Pants! A Hit! Four Stars!

From the testimonials page of a Sybase mailing:
"'Sybase . . . a brilliantly conceived and executed product, free from the constraints of history and thus able to learn from the successes and mistakes of its predecessors.'
Esther Dyson,
EDventure Holdings
(Release 1.0)"

Fleeting Fame for IBM Compatibility

"HiTech's SAM3001/386 microcomputer offers the PC market 16-MHZ speed and 1MB of RAM at a reasonable price. Centered around the Intel 80386 microprocessor, the **Compaq-compatible** system also includes a 1.2MB floppy-disk drive, an HDD/FDD controller, a 200-watt power supply, and an enhanced 101-key keyboard. . . ."
—New product announcement*, Popular Electronics, *October 1989



—Wizard of Id cartoon, April 23, 1989, by Brant Parker and Johnny Hart

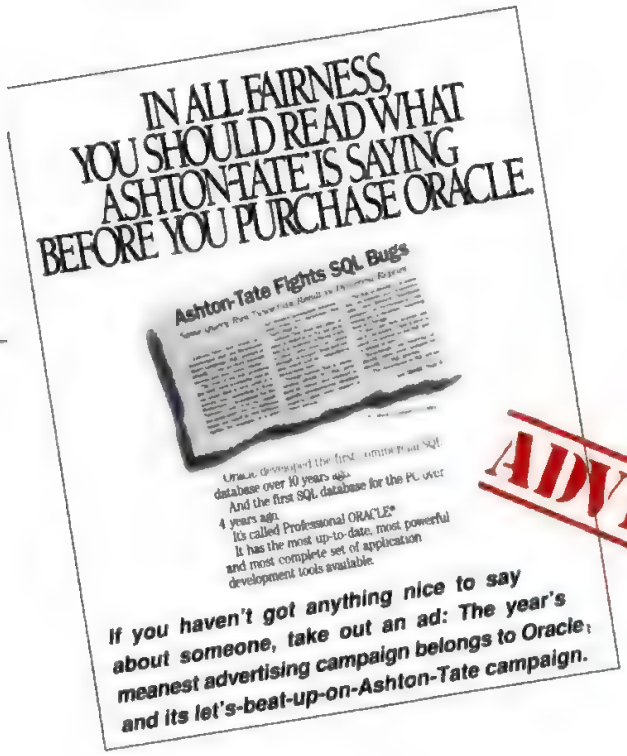
UPDATE: IBM Plans to Dominate Software Market Hit A Minor Snag

IBM DisplayWrite 5/2 provides mouse support until you switch from the word processor module to the Composer page-composition/DTP module. Then it's disabled.

Today in History: What Ever Happened to That New Portables Maker from Houston?

From *Time*'s Machine of the Year cover story, January 3, 1983: "[Adam] Osborne needed only four months to build a prototype. He limited his designer to cheap, easily obtainable parts. It takes just 40 screws and 68 minutes to assemble an Osborne I. Says a company executive: 'We've out-Japanesed the Japanese.' In fact, the Osborne is so successful that it is spawning imitators, some perhaps better than the original. Ever the optimist, Osborne is preparing to counter with a new portable. Asked about one possible rival from a new Texas firm, he replies, 'We'll kill that machine dead, dead, dead.' "

Does Jell-O have a 1-2-3 lawsuit on its hands? Does Lotus? Do Jell-O and Lotus know a best-selling toilet paper in France is also called 1-2-3?



ADVERTISING

Virus Safety Tips: Unplug Your Phone, Don't Buy Mail-Order

Advice on dealing with viruses from The CPA's News and Advisory Service on Microcomputers, February 1989:

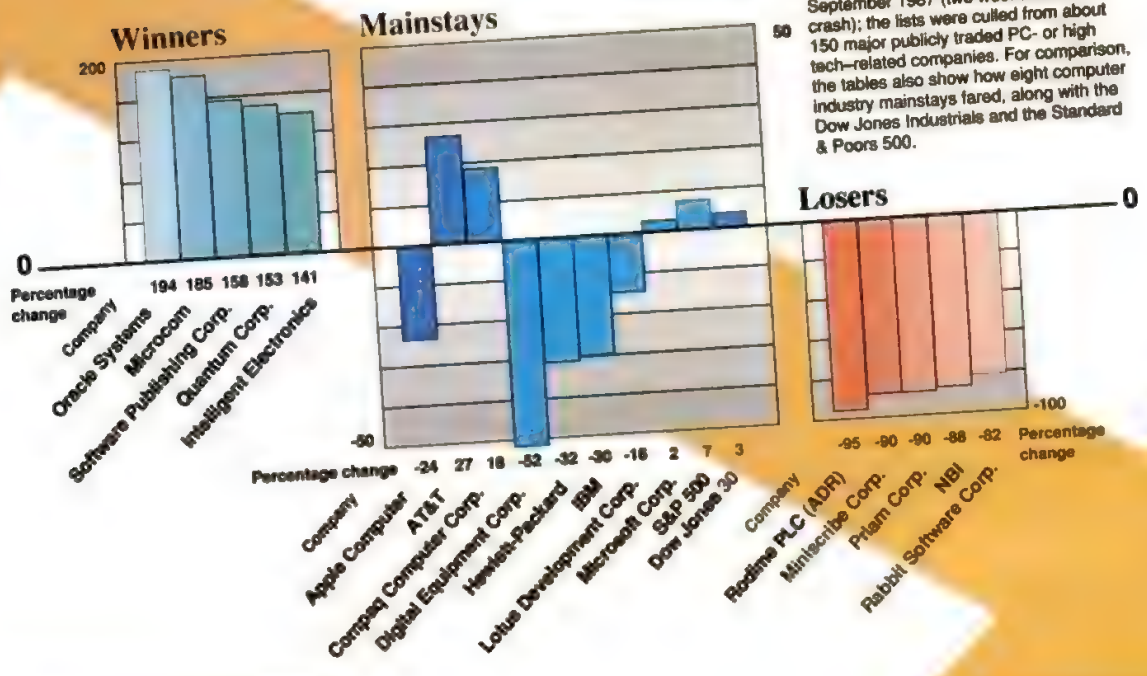
. . . require that employees and managers bring no floppy disks to the office unless they're immediately delivered for inspection to a trained computer security technician.

Telephone lines are also common viral entryways into unguarded computer systems. . . . The safest avoidance here is to unplug all phone connections. That's not always possible.

Avoid viruses disguised as programs. Do not copy public domain, shareware, or similar software. Do not buy mail-order software. . . .

CRASH PLUS TWO: HOW THE MARKET HAS FARED SINCE 1987

Wall Street seers continue to be perplexed that computer stocks don't slavishly follow the market. Here is a look at your five best and worst investments over a two-year period from the end of September 1987 (two weeks before the crash); the lists were culled from about 150 major publicly traded PC- or high tech–related companies. For comparison, the tables also show how eight computer industry mainstays fared, along with the Dow Jones Industrials and the Standard & Poors 500.



Stock research by Nordby International Inc.

LEGAL BRIEFS

•**Apple Corps Ltd., the music company once associated with the Beatles, sued Apple Computer because the Mac's sound capabilities allegedly violate a 1981 Apple-Apple agreement that lets Silicon Valley Apple use the name and an apple logo so long as it didn't sell machines "intended for synthesizing music."**

•**A New York patent-licensing firm says it owns the rights to the concept of natural order spreadsheet recalculation and seeks royalties from all major spreadsheet makers. If the company gets any money, it won't be for developing new technology. Rather, Refac Technology Development Corp. bought the rights to the technology (and the right to sue) from a Canadian company, Forward Reference Systems, that filed for the patent in the mid-1970s and received a patent in 1983.**

•**Tandy says it has a patent on laptop-computer hinges.**

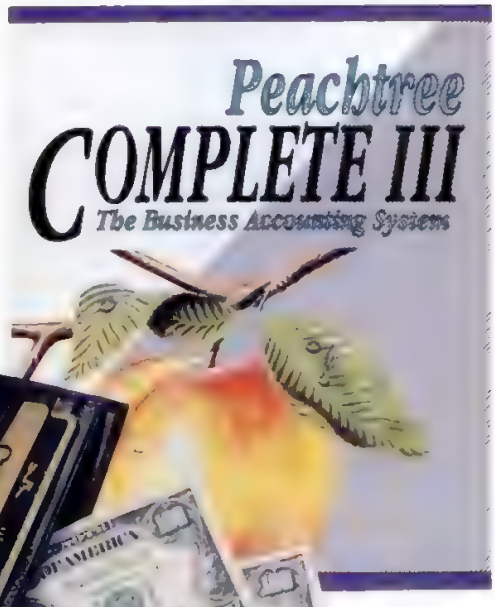
MOTTO OF THE YEAR

"Toward the harmonious development between man and computer."

—Tablet and digitizer maker Wacom Ltd.

The one accounting decision that's easy on you as well as your wallet.

NEW! Purchase Order Now Included Still $199.00



Peachtree Complete™ III is a true accounting software value — full-featured and powerful, yet easy to use. And it's even easier to afford. Over 350,000 satisfied users have already discovered that $199 gives you an incredible nine modules to handle all of your business accounting needs: General Ledger, Accounts Payable, Accounts Receivable, Invoicing, Purchase Order, Payroll, Inventory, Job Cost and Fixed Assets.

Peachtree Complete III's modular format lets you install the functions that your company needs now, then add to the system as your business expands. Set up multiple departments, even multiple companies — there's virtually no limit to your business growth with Peachtree.

Easy to Install. We give you everything you need to start using your Peachtree Complete III accounting system right away. Your package includes a Quick-Start Guide, DOS and Accounting Primer, plus an eight-volume reference library. Each module has on-line tutorials to make learning simple. And of course Context-Sensitive HELP is on-line at all times. Best of all, Peachtree provides all these materials at no extra cost!

Simple to Use. Peachtree Complete III includes system-wide features, such as scrolling reference tables, pop-up windows and short-cut keys, to help you work quickly and efficiently.

Because the nine modules work together, you can accomplish several accounting tasks with only one Peachtree Complete entry. For example, when you enter an invoice, your Inventory, Accounts Receivable and General Ledger are automatically updated. This most recent version also lets you add customers, vendors, GL accounts and other items on the fly. Plus we've built in automatic back-up of important data files to protect your valuable accounting information.

Ideal for Small Businesses. A recent survey conducted by the American Institute of CPAs showed that accountants recommend Peachtree to their small business clients more often than any other accounting program. We've included over 450 pre-defined reports to keep your business running smoothly, including financial reports, invoices, 1099s and automatic federal and state payroll tax calculations. Reports can be printed to the screen, or to one of up to four printers attached to your computer. Or save your reports to disk and print when it's convenient for you. Our range printing feature lets you choose the records you want, saving time and needless paperwork.

Save $100 With Our Double Bonus Bundle! Expand the power of your Peachtree accounting with the customized reporting capability of Peachtree Data Query™ III. From sales analysis to personalized reports, PDQ III lets you make the most of your accounting data including export to Lotus 1-2-3® and dBASE®.

You'll have safe, simple access to all the vital information stored in your accounting files. Print custom reports, graphs, histograms — and do it directly from your Peachtree Complete III menu! Peachtree's Double Bonus Bundle includes both Peachtree Complete III and PDQ III — each normally $199 — for one low price of $298. That's a savings of $100!

The Peachtree Advantage. Since 1978, Peachtree Software has delivered quality accounting software. We stand behind our products with technical support directly from Peachtree ($1 per minute, $20 minimum on your credit card) or through our nation-wide network of support centers. We also offer an unconditional 30-Day Money Back Guarantee when you buy directly from Peachtree. If for any reason you are not satisfied with our product, just return the package to us within 30 days for a prompt refund. A $25 re-stocking fee is charged on each package returned.

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Peachtree Complete I & II customers save 50% on upgrades.

Limited Time Offer.

Make the accounting decision that's easy on you as well as your wallet. Peachtree Complete III at $199 or the Double Bonus Bundle for only $298. Call to order today!

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To order by mail add $12.50 shipping and handling
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Norcross, GA 30093

"Peachtree is an excellent deal, offering more modules and features per dollar than any package we know of. It provides a better interface and more modules than many programs at a very low cost." — PC World

Hardware Specifications: Requires PC/MS-DOS version 3.0 or higher with 640K of memory and a hard disk. For use with the IBM® PC, PC XT, PC AT, Personal System/2™ and compatibles. 3½" media optionally available. IBM is a registered trademark and Personal System/2 is a trademark of International Business Machines Corp. Not copy protected.

Peachtree™ Software®

CIRCLE 358 ON READER SERVICE CARD

New Terrorist Profile: Creased Gray Suit, Hartman Two-Suiter, Nylon Bag Labeled 'SupersPort'

During the month of May:

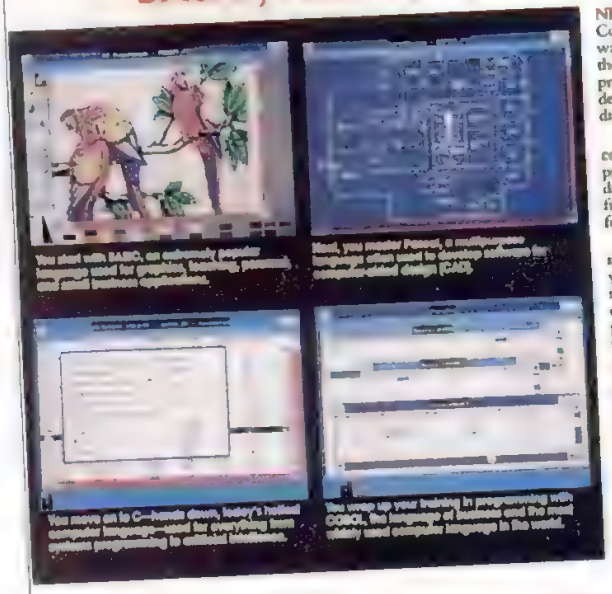
●A 37-year-old Cuban exile wearing military fatigues slipped through airport security in Los Angeles carrying two knives and a starter's pistol, flew to Dallas, and attempted to hijack an American Airlines flight to Cuba.

●Pondering ways to combat air terrorism, the Bush administration considered whether to ban laptop PCs on the grounds they could be used to conceal bombs.

Neither the hijacker nor the no-laptops scheme got through.

ILLUSTRATION: JACK DAVIS

Now, with NRI, you can learn to program in today's hottest computer languages—BASIC, Pascal, C, and COBOL



NRI's new at-home training in Computer Programming starts by walking you step by step through the fundamentals, easing you into programming with brilliantly detailed instructions, charts, and diagrams.

In no time at all, you have a complete understanding of the programming techniques used every day by successful micro and mainframe programmers. And then the fun really begins.

With your personal NRI instructor on call and ready to help, you use the computer system included in your training to actually design, code, run, debug, and document programs in BASIC, Pascal, C, and COBOL. Then, following easy-to-read instructions, you use your modem—also included—to "talk" to your instructor, meet other NRI students, even download programs through NRI's exclusive programmers network, PRONET.

Send for your FREE catalog today.

For all the details about NRI's at-home training in Computer Programming, send the postage-paid reply card today. Soon you'll receive NRI's fascinating, information-packed, full-color catalog.

Open it up and you'll find

Successful graduates can become famous Byte *editors? NRI Schools, a division of McGraw-Hill, says it will teach you to program "in today's hottest computer languages—BASIC, Pascal, C, and COBOL," illustrated by screen shots of* PC Paintbrush *(representing BASIC),* Micrografx In-A-Vision *(Pascal),* DB/Access *(C) and* Windows *(COBOL).*

Sexy underwear can blow up computers

SEXY LINGERIE and slinky ladies underwear aren't only making men go wild these days — they're also making multi-million dollar comput- | static electricity that can shut down even the most sophisticated computers,

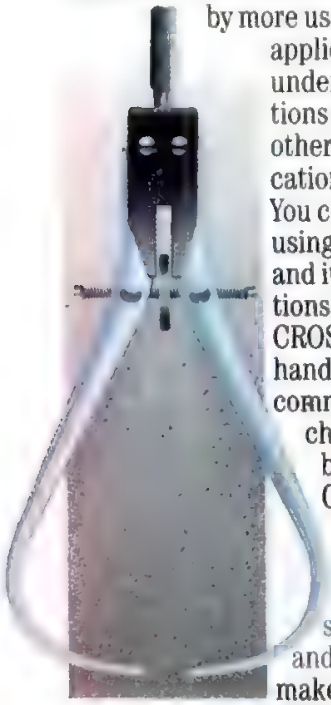
Headline in the Sun, *April 25, 1989, a weekly supermarket tabloid. According to the story, "nylon frillies produce static that make computer chips go haywire!" and "women factory workers who insist on wearing nylon undies are probably to blame for the many household appliances that go on the blink after a few months." Also in the issue: "Sound waves melt fat away in 24 hours," "Hubby back from dead finds wife wed to his pal," and "Magic chant cures Liz's backache."*

Different Jobs. Different Tools. All CROSSTALK.

No tool's just right for every job - that's why we've created a family of communications programs. You get the right tool for the communications challenges you're facing.

CROSSTALK® XVI

With over 700,000 users, CROSSTALK XVI has been proven by more users in more applications and under more conditions than any other communications program. You can continue using your PC and its applications while CROSSTALK® handles your communications chores in the background. CROSSTALK's easy-to-use commands, logical status screen, and on-line help make it the right tool. CROSSTALK XVI has been the leading PC communications program since the PC was introduced, and continuing improvement has kept it that way.

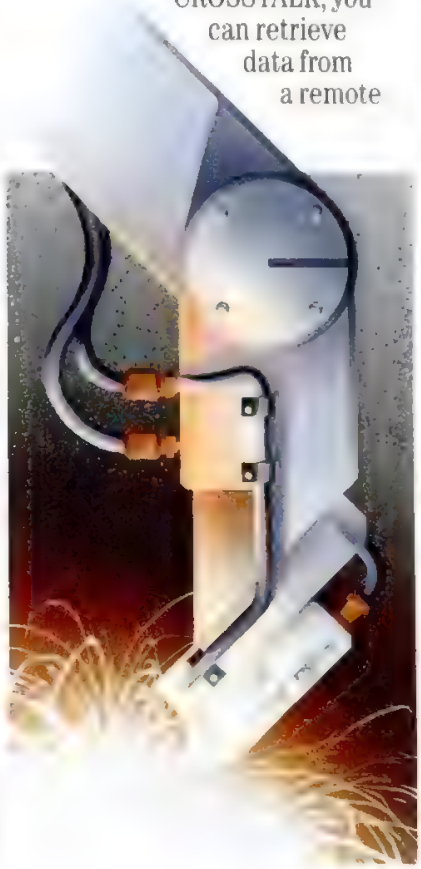


CROSSTALK® Mk.4

Ready for the future, CROSSTALK Mk.4 easily meets today's challenges. Operated by menus, Alt-keys, or commands, CROSSTALK Mk.4 is unequaled in versatility. It works with dozens of different communications devices – including networked devices – and offers over 25 terminal emulations and file transfer protocols. With the Crosstalk Applications Script Language (CASL)™ you can create custom menus and applications to help new users easily tackle complex tasks, or completely automate up to 15 simultaneous sessions. If what you're using doesn't quite fit the bill, or if you want to standardize on one package to handle all your communications needs, this is your tool.

CROSSTALK® for Windows

This tool was crafted just for the Microsoft® Windows operating environment including Dynamic Data Exchange. With CROSSTALK, you can retrieve data from a remote computer and place it directly into your Microsoft® Excel spreadsheet! Imagine the power to communicate without having to learn how – it's available from CROSSTALK. Of course, CROSSTALK for Windows offers terminal emulations, file transfers, and a powerful subset of CASL with easy-to-use pull-down menus.



All CROSSTALK programs offer you everything you would expect from today's communications programs–and more! We represent high performance easy-to-use software, offering exact terminal emulations, a variety of protocols for fast error-free file transfers, and the ability to completely automate communications tasks.

Use the right tool that fits–you'll find it under the CROSSTALK name. Call for further information.

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404-998-3998
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LAN TIMES READERS CHOICE 1989

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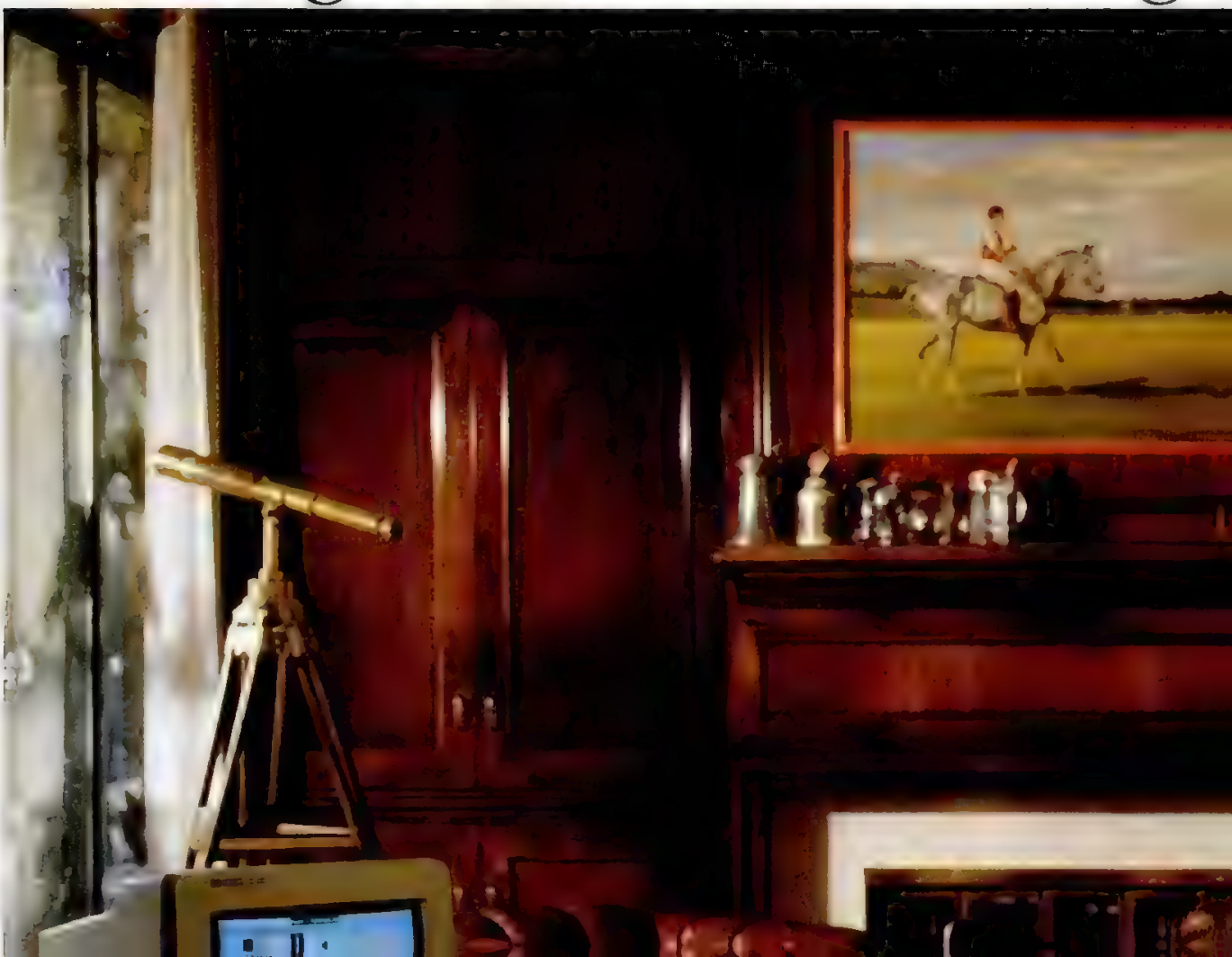
Tom bought Hewlett-Packard long



before he bought PCs.

When he got his first job on Wall Street, Tom's HP calculator was his most valued possession. It was the combination of innovation and reliability that gave him an edge. So when his Information Systems Manager recommended they go with Hewlett-Packard personal computers, Tom needed no convincing.

With Intel 286 and 386™-based models, HP's line of Vectra personal computers suits a range of business needs. Vectra PCs easily accommodate expansion. You can get up to 8 accessory slots, 620 Mbytes of hard disk storage, and 16 Mbytes of RAM. And all models accept both 5.25" and 3.5" disks.

Beyond this, HP's adherence to industry standards ensures compatibility. Now, and into the future.

But the most important feature is one that Hewlett-Packard has offered for 50 years. Exceptional quality. This, along with HP's extensive network of trained, authorized dealers, gives you all the assurance you need. For the dealer nearest you, call **1-800-752-0900, Ext. 712L**

There is a better way.

HEWLETT PACKARD

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CIRCLE 372 ON READER SERVICE CARD

Before Hiring A Project Manager, It's Wise To Check References.

"There's little else you can ask for amidst its barrage of options and features."—Lamont Wood, November, 1988. **BYTE**

"We have rated SuperProject as the number one package in the under $1,500 cost category."—Daniel Yahdav, 1Soft Decision, Inc., October, 1988.

PC MAGAZINE EDITORS' CHOICE *"Editor's choice. An extremely flexible program, rich in ways to view a project."*—November, 1988.

"In features and capacity, SuperProject Expert leads the pack."—Woody Liswood, November, 1988. **PC WORLD**

It isn't an easy thing choosing project management software.

Countless programs and features can make the task downright daunting.

But we can help.

Or, more to the point, we'd like to introduce some people who can: the editors and critics of some of the most prestigious computer magazines.

Noted above is just a sampling of their recent reviews of SuperProject,® our family of invaluable resource tools.

SuperProject Plus,® Expert and Expert/2 for OS/2 offer comprehensive control over the smallest to most complex projects. You can even develop projects on a PC, then consolidate them by uploading to a mainframe.

And that's the kind of advantage that comes only from the world's leading independent software company.

For a brochure, free demo diskette or more references, call 1-800-531-5236. In Canada call 1-800-663-6904.

Because, in the final analysis, we want your project to receive reviews along the same lines as ours.

COMPUTER® ASSOCIATES
Software superior by design.

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CIRCLE 272 ON READER SERVICE CARD

ADVERTISING

S-2 International Computer Co. Ltd. ad in Taiwan's Trade Winners: Computers & Peripherals, March 1, 1989.

LEGAL BRIEFS

Will this Sears Brand Central ad cause confusion among DEC customers? Will Digital blame Sears if users complain, "My computer sucks"?

Who Says It Makes No Sense? Next, You'll Tell Us Our Name Is Hard to Spell

From the *Syzygy* (pronounced SIZZ-uh-jee) quick start manual: "The milestones are read as the number of days before the due date of a particular task when the people involved in the completion of the task are notified that they should be addressing the task in one way or another."

MEDIA

Just Like They Taught You at the Famous Sportswriters School: Always Reach for The Big Verb . . .

"Mitac's Micro Channel-based MPS2386 . . . was reduced by $300, to $2,695. Mitac also slashed the price of its AT-bus 386SX computer by $100. The MPC2386, now priced at $2,595 . . ."
—*PC Week*, August 7, 1989 (the $100 price slashing equates to 3.7 percent)

. . . And Never Let 'Em Know You're Grasping at Similes

"These [Intel] microprocessors, which perform the critical functions inside a computer, are part of a microscopic world where dimensions are so small that a human hair is like a boulder and speeds are so blazing that a thousandth of a second is like a lifetime. . . . Semiconductor chips. . . . represent the crude oil of the information age. . . . Building Intel's [80486] chip would be like squeezing 200 cities the size of the District [of Columbia] onto a fingernail."
—*The Washington Post*, February 26, 1989

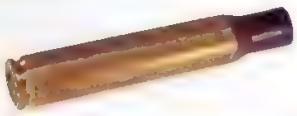
MEDIA

Wacko Prediction of the Year

Unix will hold 45 percent of the desktop PC market in 1993, OS/2 25 percent, and DOS 17 percent, according to a *Wall Street Journal* article (March 31, 1989) citing predictions by Sanford C. Bernstein & Co.

If They Remember Your Name, It Must Be Effective PR—Unless They Remember It to the FBI

Who has been shooting



PC Magazine readers?

A Polaroid-Foundation Ware Certus PR gimmick backfired when editors took "Who has been shooting the readers?" notes as threats.

Successful Marketing Strategies [*sic*] sent 50 editors of computer magazines unmarked envelopes containing spent gun cartridges and cryptic notes reading, "Who has been shooting [magazine name] readers?" Some nervous editors at other pubs called in the cops and in one case—because the unopened package felt suspicious—the bomb squad.

A follow-up mailing indicated it was the magazines' readers who were shooting themselves—in the feet—if they weren't using reliable Polaroid diskettes and Foundation Ware *Certus* data-integrity software. As a no-hard-feelings gesture, PR consultant Craig Settles sent each editor a bottle of cheap California chardonnay.

...introdu... Computer Inc. ...Macintosh computers. ...id analysts expect 1-2-3 for computers that sue the Unix operating system and for Digital Equipment Corp. computers as well.

That's probably a typo in The Wall Street Journal (March 15, 1989).

Just the VAX, ma'am
—*LAN Times*, March 1989

News Media's Slogan One Day May Be 'Just the Fax Ma'am' if Trend Persists
—*The Wall Street Journal*, October 6, 1989

Getting the Fax
—*PC Computing*, August 1989

Do You Have fax appeal?
—*Cosmopolitan*, September 1989

The Facts on Fax
—*PC Computing*, August 1989

THE FAX OF THE MATTER
—*PC Magazine*, October 17, 1989

JUST THE FAX, PLEASE
—*Portable Computer Review*, Spring 1989

LIVING
The technological fax of life
—*U.S. News & World Report*, June 5, 1989

Maybe it's boredom on the copy-edit desk. Maybe it's USA Today's pun-as-mass-art influence (sample headline: "Grave site discovery helps flesh out cannibal's story"). Whatever. We say enough already with the "just the fax" headlines.

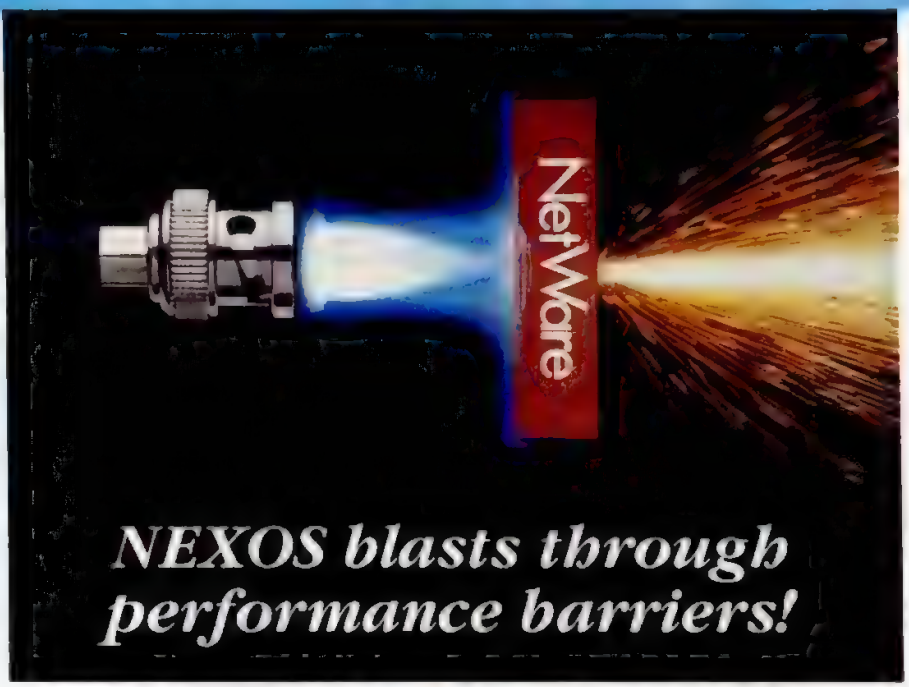
MEDIA

In Head-to-Head Tests, Twice It Blew Away a Cray, Two Vaxes, and An Apple IIgs with Dual Joysticks

"The crime itself was fairly simple. You could count the suspects on one hand and still have room for the Boy Scout salute. The company . . . used the IBM System 38, the most sophisticated piece of computer machinery in the world."
—*Texas Monthly*, March 1989

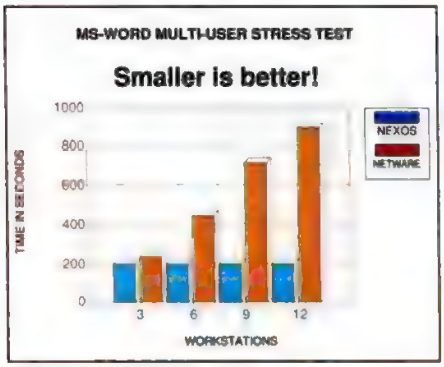
DSC NEXOS 386 LAN BEATS NETWARE!

NEXOS is the clear winner! NEXOS 386 beat NetWare® in operating system benchmark tests performed and guaranteed by the Lanquest Group, an independent test lab for the LAN industry. The results reveal the truth about NEXOS' superior performance over NetWare. In fact, NEXOS proves to be as much as ***SIX TIMES FASTER THAN NetWare.***



Fast!

In real-world, user traffic environments on industry standard hardware using well accepted, multi-user applications for database, spreadsheet and word processing, ***NEXOS beat NetWare in performance with an advantage of as much as 637%.*** You'll work faster and expand your LAN with confidence when you choose DSC NEXOS 386.



NEXOS' fast, reliable and consistent performance is clearly shown using a Compaq 386/25 server and 12 IBM PS/2 workstations running the Lanquest Group's MS-Word benchmark.

Secure!

It's important to protect fast moving data from corruption. NEXOS features a complete data integrity and protection system so powerful that your data is protected even if your power fails—***without the expense of a mirrored system or UPS.*** NEXOS always writes completed transactions to disk. If hardware problems occur during a transaction—your data will remain intact. Just restart the transaction with the original—unchanged data. NEXOS is prepared with a continuous audit trail of entries and updates recorded in real-time by NEXOS' tape transaction logging to the server's tape drive. With NEXOS your critical data is safe!

Flexible!

NEXOS gives you the flexibility, power and connectivity of ***100% DOS and NETBIOS application compatibility.*** Run all the applications your users demand and have access to UNIX, SNA hosts and the public network.

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The DSC NEXOS 386 LAN Operating System

Easy!

NEXOS' power has been harnessed with an easy to use menu system that will have the system's administrator and users ***up and running in minutes.*** Simple instructions, familiar, DOS-like commands and DSC technical support means your NEXOS LAN system will work - for you — for the users — and for your company.

NEXOS 386 is another quality networking product from DSC, a ***$340 million leader in advanced communications.*** From your desktop to around the world, DSC is delivering the quality networking solutions you demand!

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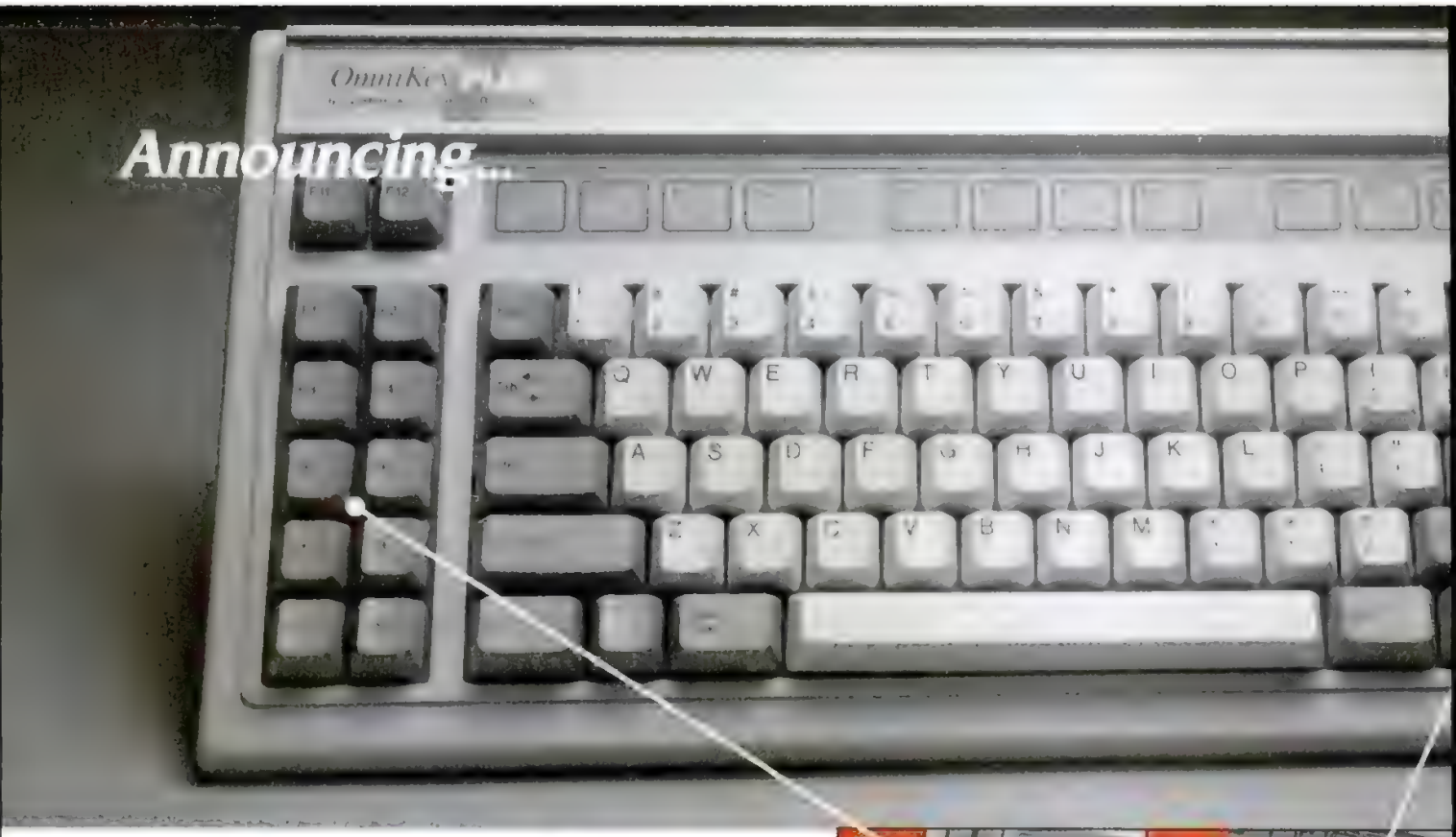

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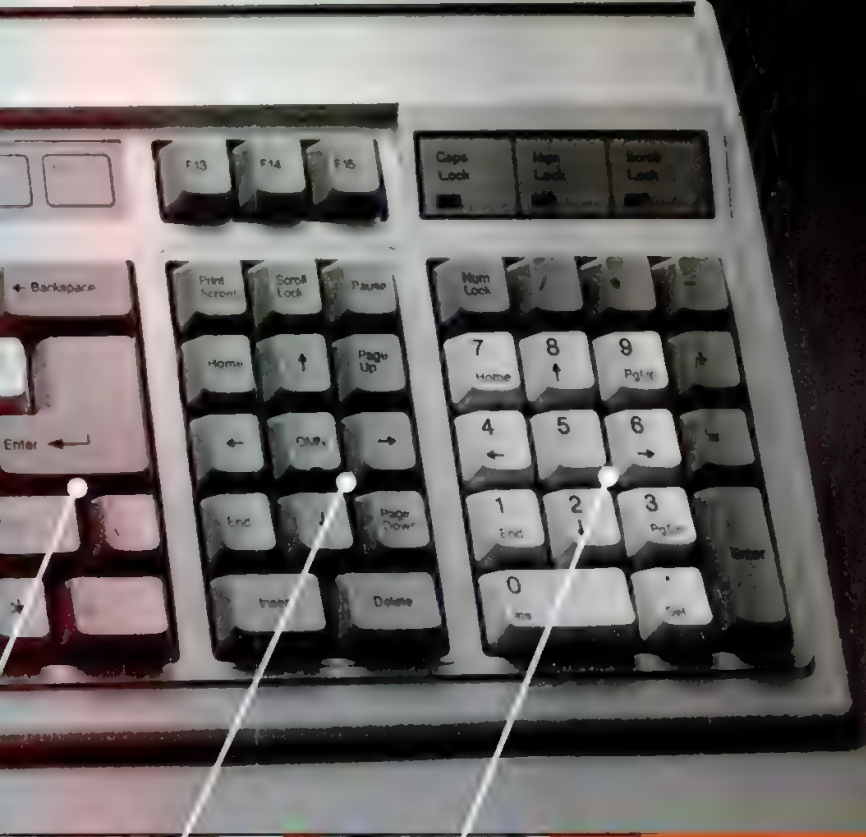

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[illegible] switch settings and the proper connecting cable. We must know the computer make and model you will be using with OmniKey/PLUS. Otherwise we cannot guarantee compatibility.

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ILLUSTRATION JACK DAVIS

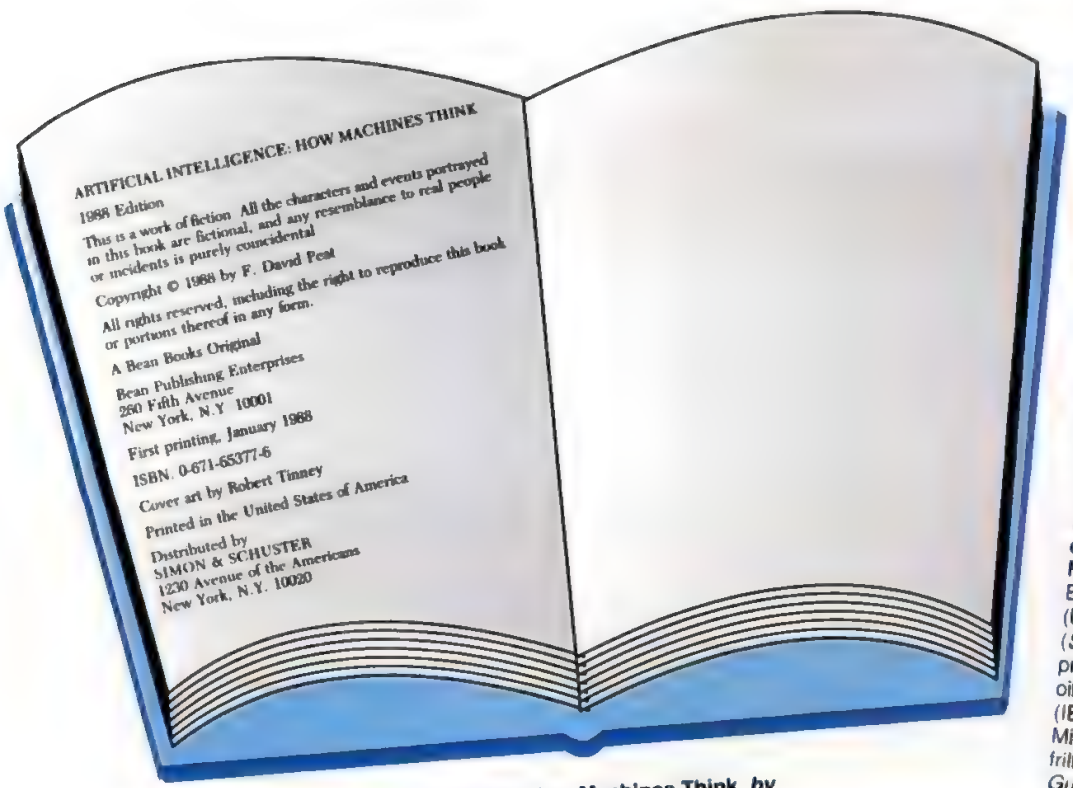
No news is good news? In this July 1989 "Special News Supplement to BYTE" magazine, 23.5 of the first 24 pages are ads. So are the last 24 pages.

Critics Said It Stood for TSRASH-DOS

"As Seidler notes, the Apple II was the first widely popular personal computer. Radio Shack was also quite successful in business environments with its terminate-and-stay resident (TSR) line."
—*LAN Times*, January 1989

Think Big

***The Microsoft Pocket Guide to Microsoft Word 5.0* measures 5.5 by 8.25 inches.**


ARTIFICIAL INTELLIGENCE: HOW MACHINES THINK

1988 Edition

This is a work of fiction. All the characters and events portrayed in this book are fictional, and any resemblance to real people or incidents is purely coincidental.

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New York, N.Y. 10001

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New York, N.Y. 10020

Title page of Artificial Intelligence: How Machines Think, by F. David Peat (Simon & Schuster, 1988).

PC Magazine gives you $50 and a free *PC Magazine* T-shirt if we use your submission in Abort, Retry, Fail? Winners this issue: Rock Miller (*Quicksilver* for Unix), Thomas A. Wielski (Sybase testimonial), Bruce Shawger (Crutchfield), William A. Cole (*Computer Buyer's Guide*), Phillip Klingler (Compaq-compatible PC), Simon Parker (*Time*), Mike Savage (Jell-O/*Lotus 1-2-3*), Lynn Berkowitz (Sears VAX), Robert Adams (Unimaginable quarlity [*sic*]), Mitt Jones (*Syzygy*), Norman Efroymson (Mitac price slashed), Grant Anderson (crude oil for the information age), Dave Horton (IBM System 38), Don Dodson (CPA Micro Report), Joseph Perry (nylon frillies), Nate Bridges (*Word Pocket Guide*), Paul Nicolette (TSR DOS), W. R. Clement (*Artificial Intelligence*).

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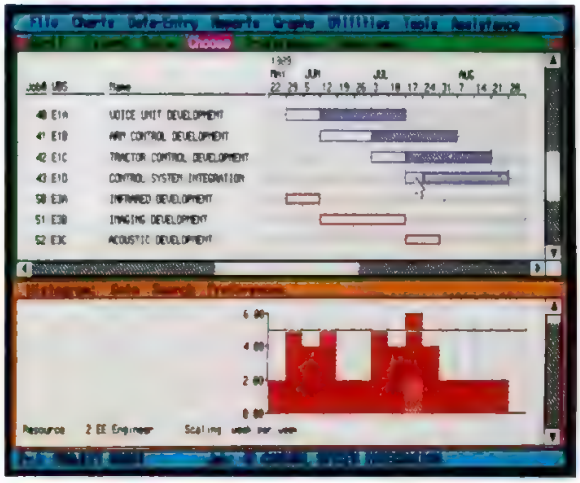
"Project Scheduler™ 4: Finally, an easy-to-use project manager"

PC MAGAZINE, SEPTEMBER 12, 1989

Everyone promises ease of use. Project Scheduler 4 really delivers. Expert after expert agrees, Project Scheduler 4 is the fast track to automated project management. And once you're started, Project Scheduler 4 keeps you going with outstanding power, world-class speed, and industry-leading capacity. Project Scheduler 4 is the clear choice for today, and tomorrow.



Our Gantt Histogram pinpoints resource overloads.

EXPERT TESTIMONY

PC WEEK, MARCH 13, 1989:
"Easy for novices to learn, but packs enough power and functionality for experienced project managers."

DESIGN NEWS, MARCH 27, 1989:
"PS4 is a thorough and complete management system. Its built-in flexibility and abundant features allow for efficient planning of even the most complex projects."

DANIEL YAHDAV, PM SOLUTIONS, JUNE 1989:
"Project Scheduler 4 earns PM Solutions' highest marks in ease of use. It leads its competition in schedule recalculation and resource leveling performance."

PC MAGAZINE, SEPTEMBER 12, 1989:
"Context-sensitive help and three levels of automatic prompting offer enough assistance that you may never open the fine manual that accompanies the program."

"Project Scheduler 4's project management graphs and charts are simply the best around."

"With good scheduling facilities, excellent graphics, and the best interface in its class, the program is well on its way to becoming the premier project manager."

INFO WORLD, SEPTEMBER 25, 1989:
"Project Scheduler 4 is the one program you can't ignore."

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ENDURANCE TESTS

386s and Portables

PHOTOGRAPH: THOM O'CONNOR

"Sure, it looks great in the Labs, but how does it hold up day after day?"

That's a reasonable question, and one that *PC Magazine* has been ill-equipped to address until now.

Our reviewers have always been as thorough and as accurate as they could be, but in this fast-paced, deadline-hungry business, time constraints are a significant factor. Recognizing your desire for information on product performance over the long term, we recruited editorial and PC Labs staff members to participate in a series of months-long, intensive tests.

by Bill Machrone

In the debut installment of our Endurance Test series, PC Magazine subjects 386s and portables to the exquisite tortures of everyday use.

For this first installment of what we have come to call "Endurance Testing," we subjected 14 products to the exquisite tortures of everyday use. We selected nine winning machines from our 386 special issue (*PC Magazine*, May 30, 1989), as well as five of the hottest portables. Products that were not previous Editor's Choice recipients merited inclusion either for their technological significance or because they are market leaders. Using the same criteria, we'll explore other product categories, including graphics, scanners, and printers, in coming months.

OUR REVIEWERS

Mary Kathleen Flynn is an associate editor of *PC Magazine*.
Lori Grunin is an assistant editor of *PC Magazine*.
Bill Howard is an executive editor of *PC Magazine*.
Robert W. Kane is a project leader at PC Labs.
Bill Machrone is editor-in-chief and publishing director of *PC Magazine*.
Pamela Milland is a project leader at PC Labs.
Rock Miller is a staff editor of *PC Magazine*.
Bill O'Brien is a former PC Labs project leader and a frequent contributor to *PC Magazine*.
Salvatore P. Ricciardi is an editor, writer, and software developer based in New York.
Donald P. Willmott is an associate editor of *PC Magazine*.
Jennifer Zaino is a staff editor of *PC Magazine*. ■

Our reviewers were encouraged to use their creativity to push these machines to their limits. If you had walked into any of their offices during the review process, you might have found them gleefully installing notoriously finicky software or swapped add-in boards.

You won't be surprised to learn that most of the units we put through these maneuvers held up well over the long run. However, we also uncovered some glitches that only time would reveal—and found a few products that didn't live up to their initial promise.

PERSONAL EXPERIENCE, NOT STATISTICS

The products we review here (and will review in future issues) come to us through various channels. In most instances, they were sent to us by the manufacturers on extended loan. Some of the systems that had previously met our working definition of Editor's Choice (that is, the kind of product we would buy with our own money) had already been purchased for in-office use before the project began. These systems, and their users, were immediately recruited for the assignment.

While most of the products have not gone through major changes since they were last covered in the magazine, some have received field upgrades. Our policy for all long-term tests is that if a substantial upgrade occurs during the course of the testing—and if we have enough time to give the revision the workout we gave to its predecessor—we'll include hands-on information about it in the review.

We're not going to pretend for a minute that our Endurance Test reports are representative of the installed base of any of these systems. This is not a statistical sampling; in almost all cases (in this and future endurance test reviews), it's just one product. Your experience with these units may be entirely different from our own. Use our reports as a confirmation, a caution, or a leading indicator.

The systems covered here account for just a small fraction of the products that we review each year. Reports like this on a periodic basis will keep you informed of our long-term satisfaction (or lack thereof) with products that cross our path. As always, we encourage your feedback.

386 PCs

Compaq Deskpro 386/25

by Pamela Milland

Oh Compaq! my Compaq! the endurance test is done.

The outcome? The hardy Deskpro 386/25 weathered the journey with ease, its speed boosted by a 32K RAM processor cache and interleaved memory. In addition, the machine benefitted from built-in extras like an 80387 coprocessor and a tape backup drive.

Despite such goodies, this market-leading computer didn't get Editor's Choice in our special 386 issue (*PC Magazine*, May 30, 1989) chiefly because of pricing considerations. Although its cost has gone down a couple of thousand dollars since that review, it still logs in at a budget-busting $19,414. But after six months with this system, I can see why many companies don't balk at laying out the big bucks.

The machine is a breeze to set up. Already low-level-formatted, it just needs Compaq's MS-DOS 3.31's FDISK. Compaq's DOS allows large partitions—all 300 megs as one hard drive—so locating errant files was usually easy. Fragmentation, the one possible drawback, has not been a problem.

The keyboard has a comfortable touch and can be plugged in from the front. The keyboard that came with the machine had a CapsLock key that worked only about 30 percent of the time. I sent it back and got a new one in just days: it's covered under the warranty, and Compaq will replace—not fix—broken keyboards, even if you're not with *PC Magazine*.

Some flimsy designs and workmanship pass through PC Labs, so one learns to appreciate attention to detail. This computer is going to last. I don't want to give it back, chiefly because it always *works*! I never get a "failure reading drive A:" error, a regular event with my other 386. I use Ctrl-Alt-Del only after painting myself into a corner; the hardware never corners me. My other machine, which screams for a glare screen, had me regularly downing aspirin to cure the headaches. Not so with the glare-free Compaq.

Prices be darned! I'd fight to get this as a CAD or desktop publishing workstation, or even file server for a small network, for one reason: reliability. There's something to be said for the peace of mind that comes with owning a problem-free machine.

Compaq Deskpro 386/25
Compaq Computer Corp., 20555 SH 249, Houston, TX 77070; (800) 231-0900 (dealer locator).
List Price: With 5MB RAM, 300MB hard disk, 150/250MB tape backup, 1.2MB 5.25-inch floppy disk drive, VGA board, Video Graphics color monitor, 80387/25 coprocessor, $19,414.

CIRCLE 309 ON READER SERVICE CARD

COMPAQ DESKPRO 386/25

Last review: May 30, 1989; page 135
Reason selected: Market leader
Positive findings: Sturdy, solid, and built to last; unfailing performance brings peace of mind.
Negative findings: High price: even Malcolm Forbes didn't get one for his birthday last year.

RELIABILITY
COMPATIBILITY
PERFORMANCE

DataWorld Data 386-25A

by Bill O'Brien

The DataWorld Data 386-25A that has been my constant companion over the past few months has proved an excellent machine, easily adaptable to all my computing needs.

The original $6,828 tower configuration included one lone high-density 5.25-inch drive, but the variety of work I do demanded that I add on a high-density 3.5-inch floppy. I also decided to slide a Wangtek tape drive into a half-height bay, just in case the 150MB ESDI hard disk fell victim to amnesia. (It never did.)

Installing these additions gave me a chance to look over the Data 386-25A's topography. I'm pleased to report that DataWorld has produced a clean and uncluttered interior. There were no surprises when I wanted to fill a vacant drive bay or stuff a slot with the tape controller card.

I wound up tossing the keyboard and plugging in a Northgate Omnikey 102 Plus. Despite the ingenuity of the Data 386-25A keyboard's acrylic dust cover, which when open doubles as a reader stand, it's much too light for my incessant pounding and woefully lacks the tactile feedback I require.

Transferring the contents of my Dell machine to the DataWorld via *Paranet* proceeded without incident. Running Lucasfilm's *BattleHawks:1942*, a World War II combat flight game, gave me more than just a chance to hone my reflexes. The program's vivid video animation thoroughly exercises graphics adapters. The included Video Seven V-RAM VGA board, along with the NEC MultiSync II, hardly broke a sweat.

Before running *Microsoft Windows/386*, to which I am helplessly addicted, I disabled the BIOS shadowing (the program at times refuses to recognize the A: drive on some 386s when shadow RAM is in place). Once that was taken care of, *Windows/386* had a stunning debut. The switch among active windows was smooth, and there appeared to be no lag in activity. However, I did have a nagging feeling that every time the program went back to the disk for anything large, things slowed down. The benchmark-test results (May 30, 1989) showed that the Micropolis 150MB ESDI drive tended to be a little slower than that of some competitors.

Other than that, the 386-25A's performance has been exemplary. The additions and substitutions I made, though necessary, served only to complement a highly competent piece of hardware.

DataWorld Data 386-25A
DataWorld Inc., 3733 San Gabriel River Pkwy., Pico Rivera, CA 90660-1495; (800) 722-7702, (213) 695-3777.
List Price: With 4MB RAM, 150MB Micropolis ESDI drive, 1.2MB 5.25-inch floppy disk drive, Data Technology Corp. (DTC) controller, Video Seven V-RAM VGA board, NEC MultiSync II monitor, DOS 3.3, $6,828.

CIRCLE 400 ON READER SERVICE CARD

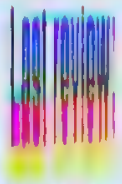
Dell System 310

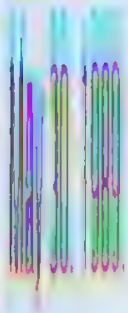
by Bill Howard

In "Silver Blaze," Sherlock Holmes drew Dr. Watson's attention to the curious incident of the dog in the night. "The dog did nothing in the nightime," said Watson. "That was the curious incident," replied Holmes.

Well, after six months with Dell's 20-

DELL SYSTEM 310





page 164
Reason selected: Editor's Choice
Positive findings: Dependable performance, good speed, Super VGA video option, superb documentation, excellent technical support.
Negative findings: Unresponsive keyboard (space bar especially).

RELIABILITY
COMPATIBILITY
PERFORMANCE

to an early Datadesk keyboard while running an ornery copy of *Lotus Express* under Compaq DOS. Not much else fazed it.

The biggest drawback is the keyboard. The Key Tronic keyboard is solid, but the keys require more pressure than do other units, especially the Spacebar.

Dell's setup manuals are a mode for the industry: nice artwork, no technobabble. Telephone technical support is knowledgeable and never hands you the kiss-off phrase, "Call yer dealer." Dell has also been one of the pioneers in supplying instant-gratification on-site service and a 30-day free trial period.

If you've followed the company's maturation from mail-order price leader PC's Limited to button-down Dell Computer, you know it has been working to reposition its machines as IBM- and Compaq-class competitors available through direct channel (the grown-up term for mail order). Since systems from Compaq, IBM, and Dell all seem to be relatively well built, I'd rather pay less and get a PC from the company that sends the repairman to me. The System 310, after a recent round of price cuts, runs about $1,000 less than a discounted Compaq Deskpro 386/20e.

No matter which of these modes you use,

40-column CGA Text
40-column EGA Text
40-column VGA Text
80-column CGA Text
80-column EGA Text
80-column VGA Text
Lo-res CGA Graphics
Hi-res CGA Graphics
MDA Monochrome Text
80-column VGA Monochrome Text
Lo-res MCGA Graphics
Lo-res VGA Graphics
Med-res VGA Graphics
EGA Monochrome Graphics
Hi-res EGA Graphics
Hi-res MCGA Graphics
Hi-res VGA Graphics

we have the VGA display for it.

Magnavox introduces two new Professional Series displays that are fully compatible with all 17 VGA modes—both designed with the intelligence you've come to expect from Magnavox.

400 for text, and 640 x 480 in 256 colors for graphics.

Both displays have a 14" CRT, versus the 12" industry standard. And both come with a built-in tilt swivel base and are backed by a 3-year limited

IBM PS/2 Model 70-A21

by Lori Grunin

My usual work machine is a poky 9-MHz AT, so when presented with the opportunity to use a 25-MHz 80386 system for an extended period, I jumped at the chance. At first I was thrilled by the velocity with which IBM's $10,122 Model 70-A21 let me race through my work, awed by the 120MB hard disk that was four times the size of my old one, and grateful for the amount of desk space the machine's small footprint freed up. Then the honeymoon ended.

After installing a mouse, the computer consistently gave a boot-up error. It turned out that in certain early batches of the machine, the BIOS fails to detect the mouse attached to the mouse port and doesn't set the BIOS pointing device bit. Consequently, mouse drivers can't load. Instead of taking the time to get the motherboard replaced (even though on-site service is available), I opted for a software patch (found on the MSAPPS forum on CompuServe) and six months of hitting F1 to bypass the boot error.

My next challenge was finding the best way to move files from the Model 70 onto 5.25-inch diskettes. Since my AT lacks a parallel port, I settled on connecting the two machines serially using Traveling Software's *Desk-Link*. To my chagrin I discovered that the nonstandard UART chip used by the Model 70's serial port precluded data transfers at speeds greater than 38.4 kilobits per second. Often-transferred 256K graphics files took an eternity.

Having had a couple of years of personal experience with the IBM 8513 Color Display that accompanies the Model 70-A21, I refused to relinquish my Zenith flat tension mask (FTM) monitor. In comparison, the IBM screen is too small, the characters too fuzzy, and the colors are too muted—with a tendency to bleed.

Fortunately, my internal modem worked fine, and I experienced no software incompatibility problems, even with bears like *DESQview*, *Microsoft Windows/386*, *Lotus Express*, and a few TSRs that I crammed into my insufficient 2MB (of which the machine uses 128K for shadowing the ROM and video BIOSs).

If it meant going back to my old AT, they'd have to drag the Model 70 out from under my lifeless body; but if I were given a comparably equipped ISA-bus machine in exchange, I'd gladly wave goodbye to my quirky compatriot of the past six months.

IBM PS/2 Model 70-A21
IBM Corp.; contact your nearest authorized IBM dealer: (800) IBM-2468.
List Price: With 2MB RAM, 120MB hard disk, two 1.44MB 3.5-inch floppy disk drives, 8513 color VGA monitor, DOS 3.3, $10,122.

CIRCLE 402 ON READER SERVICE CARD

IBM PS/2 MODEL 70-A21

Last review: May 30, 1989; page 212
Reason selected: Editor's Choice
Positive findings: Top speed and a small chassis; switchless board installation, and a front-panel power switch.
Negative findings: Irritating, productivity-impeding quirks, including a nonstandard UART chip and too few ports and slots.

RELIABILITY
COMPATIBILITY
PERFORMANCE

Micro 1 Power 386-16

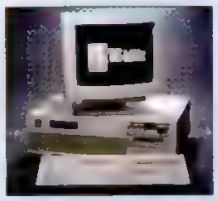
by Mary Kathleen Flynn

Instead of wondering how the Micro 1 Power 386-16 will hold up over the long haul, many PC users doubt if the company itself will survive.

In last year's special 386 issue (May 30, 1989), the fast, low-priced machine impressed us enough to earn an Editor's Choice. Then we heard from over a dozen would-be Micro 1 customers who were aghast at our decision. These readers ordered machines, sent in their checks, received wait-another-week replies to their complaints about delays, cancelled their orders, and didn't get their money back.

Still, the situation may improve. In April of last year, Micro 1 founder Rick McKay sold his majority interest to venture capitalists Jerry Silbert and Len Levin. According to McKay, now director of sales and marketing, Silbert and Levin have put $1 million into the company since filing a Chapter 11 petition. If the Bankruptcy Court accepts the 100 percent repayment plan Micro 1 has submitted, the company will be out of Chapter 11 by the time you read this. Angry customers will get their money back—eventually.

MICRO 1 POWER 386-16



Last review: May 30, 1989; page 236
Reason selected: Editor's Choice
Positive findings: Low price, reputable components.
Negative findings: System locks when machine runs out of memory; keyboard has tendency to repeat keys; company has a history of financial instability.

RELIABILITY
COMPATIBILITY
PERFORMANCE

Micro 1 (currently suing MultiMicro, its original supplier) is now doing its own manufacturing and technical support at its headquarters in Mesa, Arizona, and claiming next-day delivery.

What about the machine itself? Generally, the model I've lived with for the past six months has been well behaved. Equipped with 2MB RAM, a 45MB Toshiba hard disk, 1.2MB and 1.44MB floppy disk drives, Paradise VGA card, 80387 math coprocessor, and DOS 3.3, the system sells for $3,325—about $60 less than when we last reviewed it.

I had no problems using 1,200- and 2,400-bit-per-second external Hayes Smartmodems or running a variety of software, from *Lotus Express* to several *PC Magazine* utilities. But I often ran into memory snags when trying to load *XyWrite* after shelling out of *ProComm Plus*. The system locked and wouldn't respond to anything less than a cold reboot.

I like the Key Tronic 101-key keyboard, though it has a tendency to repeat a character every now and then. And the Relisys monitor isn't my favorite; I find its characters fuzzy and its case bulky.

If Micro 1 gets its financial act together, it could become an important supplier of low-priced, reasonably solid 386 PCs. Before laying down your money, though, it's a good idea to read up on the company's financial performance in the weekly computer-news publications.

Micro 1 Power 386-16;
Micro 1 Inc., 557 Howard St., San Francisco, CA 94105; (800) 338-4061, (415) 974-5439.
List Price: With 2MB RAM, 45MB hard disk, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, VGA monitor, 80387 coprocessor, DOS 3.3, $3,325.

CIRCLE 604 ON READER SERVICE CARD

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□ 3½" format available from us. Specify when ordering.
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Ⓑ 3½" format available from manufacturer by request. Call us for details.
CP—copy-protected; **NCP**—not copy-protected.

The four-digit number next to each product is the product's ITEM NUMBER. Please refer to this number when ordering. Thank you.

SOFTWARE

We only carry the latest versions of products. Version numbers in our ads are current at press time.

Aldus ... NCP
1332 □PageMaker 3.0 ..... call
Alpha Software ... NCP
5104 ◉ALPHA/four 1.0 ..... 319.
Application Techniques ... NCP
1214 ◉Pizazz Plus 1.3. ..... 69.
Ashton-Tate ... NCP
4450 □dBASE IV 1.0 ..... call
Autodesk ... NCP
4519 □Autosketch 2.0. ..... 95.
6119 □Autosketch Animator 1.0 ..... 189.
Bitstream ... NCP
◉Fundamentals: Newsletters, Flyers, or Books & Manuals ..... *each* 159.
◉Headlines *(1 to 6)*. ..... *each* 99.
◉Individual Fonts ..... *each* 99.
Bloc Publishing ... NCP
1447 □FormTool 2.01 ..... 55.
4594 □Form Filler 2.0 ..... 89.
Borland International ... NCP
1498 Ⓑ Turbo C 2.0 ..... 105.
4330 Ⓑ Turbo C Professional Pack 1.0 .... 175.

Chipsoft ... NCP

Ⓑ *Turbo Tax 1989 Personal 1040 7.0*–Now available! Award winning tax preparation software with a wide variety of federal income tax forms & schedules. Fast & easy to use. 1989 World Class PC Award Winner... **$45.**

5335 Ⓑ Turbo Pascal 5.5 ..... 105.
4332 Ⓑ Turbo Pascal Professional Pack 1.0. 175.
1521 Ⓑ Quattro 1.0 ..... 149.
1514 ◉Paradox 3.0. ..... call
Bourbaki ... NCP
4524 □1DIR + 3.0 ..... 49.
Bridgeway Publishing ... NCP
4386 □FastTrax 3.9 ..... 35.
Brightbill-Roberts ... NCP
5408 □Hyperpad 1.0 ..... 89.
5843 □Show Partner F/X 3.5 ..... 229.
Broderbund ... CP
1434 □New Print Shop ..... 39.
1433 ◉Memory Mate 3.01 *(NCP)* ..... 45.
Caere ... NCP
6004 ◉Omnipage 386 2.0 ..... 599.
Central Point ... NCP
5039 ◉PC Tools Deluxe 5.5. ..... 77.
5038 □Copy II PC 5.0. ..... 27.
Chipsoft ... NCP
1663 Ⓑ TurboTax for 1989 Taxes 7.0 ..... 45.
Ⓑ Individual States *(avail. 1/90) each* 34.

Corel Systems ... NCP
5506 □Corel Draw 1.1. ..... $329.
Crosstalk Communications ... NCP
2911 □Remote² 2.0. ..... 109.
2908 □Crosstalk XVI 3.7 ..... 109.
5611 □Crosstalk for Windows 1.0 ..... 129.
DacEasy ... NCP
1756 ◉Dac Easy Payroll 4.0 ..... 59.
1748 ◉Dac Easy Accounting 4.0. ..... 89.
Data Storm ... NCP
4798 ◉PROCOMM PLUS 1.1 ..... 52.
Delrina Technology ... NCP
4325 ◉PerFORM 2.0. ..... 169.
Delta Technology ... NCP
5829 ◉Direct Access 4.1. ..... 52.
Digital Composition Systems ... NCP
5876 ◉db Publisher Report Maker 2.0 . 185.
5th Generation ... NCP
5504 ◉Brooklyn Bridge 3.0. ..... 79.
4688 □Mace Gold 1.0. ..... 89.
3950 ◉Fastback Plus 2.09 ..... 109.
FormWorx ... NCP
5810 □FormWorx System 2 1.0. ..... 169.
Fox Software ... NCP
6188 Ⓑ FoxPro 1.0. ..... 489.
Funk Software ... NCP
2228 □Sideways 3.21 ..... 42.
4479 □Allways 1.0 ..... 85.
Generic Software ... NCP
2265 Ⓑ Generic CADD Level 3 1.13. ... 169.
Great American Software ... NCP
4880 □One Write Plus Accounting Sys. 2.0 .179.
5825 □Money Matters 1.0. ..... 55.
Harvard Associates ... NCP
2324 Ⓑ PC Logo 3.0 ..... 59.
Hayes ... NCP
2293 ◉Smartcom II 3.0. ..... 89.
Hilgraeve Software ... NCP
2323 ◉HyperACCESS/5 1.0 *(DOS & OS/2)* 115.
IBM ... NCP
6187 ◉Storyboard Plus 2.0. ..... 239.
6186 □DisplayWrite 4 2.0 ..... 249.
Individual Software ... NCP
2408 □Professor DOS 4.0. ..... 27.

Broderbund ... CP

□*New Print Shop*–Create & print greeting cards, signs & flyers, invitations, certificates, letterheads, banners, calendars, and posters. Includes a true WYSIWYG interface and expanded font and graphics support .. **$39.**

Corel Systems ... NCP

□*Corel Draw 1.1*–*PC Magazine* called it "A walloping good freehand drawing program that is easy to learn and fun to use. Highly recommended." ..... **$329.**

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2426 ◉Quicken 3.0 ..... $39.
Lord Publishing ... NCP
5191 ◉Ronstadt's Financials 1.02 ..... 145.
Lotus ... NCP
5417 □1-2-3 3.0 ..... call
5653 □1-2-3 2.2 ..... call
5134 ◉Magellan 1.0 ..... 149.
4131 ◉Agenda 1.0 ..... 275.
2660 □Freelance Plus 3.01 ..... 345.
MECA ... NCP
4603 ▣Tax Cut for 1989 Taxes ..... 49.
2798 □Managing Your Money 6.0 ..... 119.
Microcom ... NCP
2775 □CarbonCopy Plus 5.1 *(2 req.)* ... 115.
Micro Logic ... NCP
2968 □Tornado 1.8 ..... 55.
Microlytics ... NCP
2731 □GOfer 2.0 *(new version)* ..... 45.
Microrim ... NCP
2835 ◉R:BASE for DOS *(version 2.1)* ... 489.
Microsoft ... NCP
2860 □Learning DOS 2.0 ..... 35.
2899 □Windows 286 2.1 ..... 69.
2904 □Works 2.0 ..... 99.
2900 ◉Windows 386 2.1 ..... 129.
2901 □Word 5.0 ..... 209.
6195 ◉Word for Windows ..... 329.
2856 ◉Excel 2.1 *(req. 80286/80386)* ... call
6033 ◉Excel for OS/2 1.0 ..... 339.
5188 □QuickPascal 1.0 ..... 69.
2894 □QuickBASIC 4.5 ..... 69.
2895 □QuickC 2.0 ..... 69.
5410 □QuickC 2.01 w/Assembler ..... 139.
2853 ▣C Compiler 5.1 ..... 299.
Multisoft ... NCP
4925 □PC-Kwik Power Pak 1.5 ..... 79.
Nantucket Software ... NCP
2970 ◉Clipper *(Summer '87)* ..... 429.
New England Software ... NCP
4337 □GB-Stat 1.5 ..... 159.
Nolo Press ... NCP
2982 □WillMaker 3.0 ..... 35.
5122 □For The Record 1.0 ..... 35.

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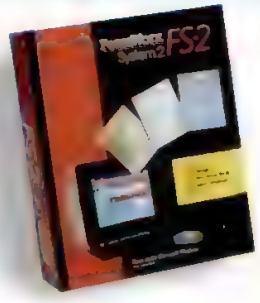
▣*FoxPro 1.0*–Offers an elegant windowing interface, blazing speed, and perfect dBase language support along with an array of incredible new features that simplify database management ..... $489.

North Edge Software ... NCP
2987 □Timeslips III 3.4 ..... $169.
Norton-Lambert ... NCP
4928 □Close-Up Customer 3.0 ..... 135.
4929 □Close-Up Support 3.0 ..... 165.
Paperback Software ... NCP
3142 □VP-Planner 3D 1.0 ..... 169.
PC Globe ... NCP
5902 □PC Globe 3.0 ..... 39.
Personics ... NCP
3126 ◉SeeMORE 2.0 ..... 54.
4328 ◉Look & Link 1.1 ..... 59.
Peter Norton ... NCP
3152 ◉Norton Commander 3.0 ..... 89.
3146 ◉Advanced Utilities 4.5 ..... 89.
Quarterdeck ... NCP
3221 □Expanded Memory Mgr. 386 5.0 . 59.
3220 □DESQView 2.26 ..... 79.
4586 □DESQView 386 ..... 129.
Reference Software ... NCP
4396 ◉Grammatik IV 1.0 ..... 52.



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◉*FormWorx System 2 1.0*–New! Powerful forms processing software that runs under Windows to combine WYSIWYG forms design, fill-in, math, & relational database features in one complete package.... $169.

Revolution Software ... NCP
4480 ◉VGA Dimmer 2.01 *(screen saver)* . 19.
Rightsoft ... NCP
4155 ◉Rightwriter 3.1 ..... 54.
Samna ... NCP
5799 ◉Ami Professional 1.0 ..... 319.
Softlogic Solutions ... NCP
3546 □Disk Optimizer 4.05 ..... 45.
3542 □Software Carousel 3.01 ..... 55.
Softview ... NCP
3474 ▣MacInTax for Windows *(1989 taxes)* 65.
Software Publishing ... NCP
3499 □PFS:First Publisher 2.1 ..... 89.
3478 □PFS:First Choice 3.02 ..... 105.
3496 ◉Professional Write 2.11 ..... 149.

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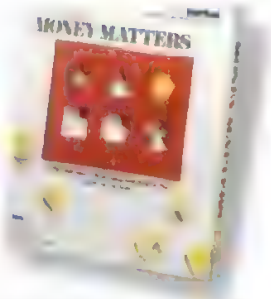

Great American Software ... NCP
□*Money Matters 1.0*–New! Small business/home office accounting. More than checkwriting; includes invoices, financials, budgets, inventory, jobs & more. Easy Quick Start section & exclusive SuperTrack feature . $55.

3493 ◉Professional File 2.01 ..... 199.
3482 □Harvard Graphics 2.13 ..... 339.
Spinnaker ... NCP
4441 □Resume Kit 1.29 ..... 25.
Symantec ... NCP
3427 ◉Q & A Write 1.01 ..... 139.
3412 ◉Grandview 1.0 ..... 189.
3425 □Q & A 3.0 ..... 229.
3431 □Timeline 3.0 ..... 399.
TOPS ... NCP
3724 ▣NetPrint 2.0 *(share printers)* .... 119.
3726 ▣TOPS 2.1 ..... 115.
3720 *Flashcard 2.1 (AppleTalk network card; 1 year warranty)* ..... 159.
Traveling Software ... NCP
4190 Battery Watch 2.0 *(3½" only)* ..... 35.
5179 ◉LapLink III 3.0 ..... 85.
True BASIC, Inc. ... NCP
3561 ◉True BASIC 2.1 ..... 52.
Vericomp ... NCP
3765 ◉SoftBytes 2.0 ..... 35.

Softview ... NCP
▣*MacInTax for Windows*–the only Windows-based tax preparation software, displays and prints 75+ exact replicas of IRS forms, schedules and worksheets with no font cartridge needed..... $65.

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3799 ■ WordPerfect Library 2.0..... 75.
3804 □ WordPerfect 5.1..... call
3805 ■ WordPerfect Network 5.1..... 389.

WordStar USA ... NCP

2825 □ WordStar Prof. Release 5.5 .... 229.
5000 □ *Upgrade to Release 5.5*..... 89.

Xerox ... NCP

3812 □ Ventura Publisher 2.0 ..... call

XTREE Co. ... NCP

6161 ■ XTREE Pro Gold 1.0 ..... 75.

XYQUEST ... NCP

4393 □ XyWrite III Plus 3.55..... 229.

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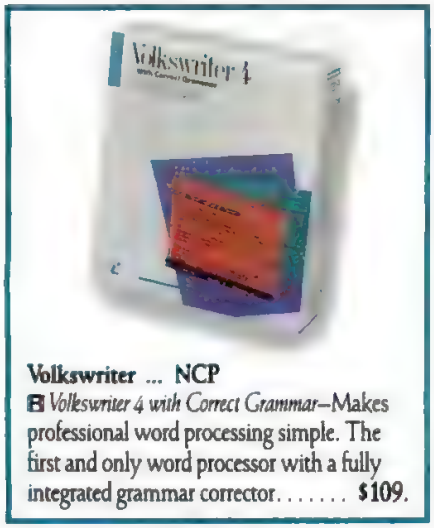
Accolade ... CP

6031 □ Hardball 2..... 26.
6030 □ Test Drive 2: The Duel ..... 29.



Volkswriter ... NCP

■ *Volkswriter 4 with Correct Grammar*–Makes professional word processing simple. The first and only word processor with a fully integrated grammar corrector..... $109.

Broderbund ... CP

1417 □ Where/Europe Carmen Sandiego? $29.
5701 □ Where/Time Carmen Sandiego? ... 32.
5851 ■ Sim City..... 33.

Electronic Arts ... CP

5798 □ Ferrari Formula I ..... 29.
5806 □ F-16..... 35.
5804 ■ Deluxe Paint II *(Enhanced)*..... 89.

Konami/Ultra Software ... CP

6194 □ Teenage Mutant Ninja Turtles .... 29.
6192 □ Ninja Turtles/Kraft ThunderStick .. 54.

Microprose ... CP

4454 □ F-19 Stealth Fighter ..... 39.
5823 □ Red Storm Rising..... 39.

Microsoft ... NCP

2858 □ Flight Simulator 4.0 *All New* ..... 39.

Parlor Software ... CP

3159 □ Bridge Parlor 2.3..... 49.

Sierra On-Line ... CP

6023 ■ Leisure Suit Larry III..... 39.
4345 ■ King's Quest IV *(512k version)* ... 33.
5695 ■ Manhunter: San Francisco..... 33.
4456 ■ Police Quest II ..... 33.
5106 ■ Space Quest III ..... 36.

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Spectrum Holobyte ... NCP

5993 ■ Welltris *(Tetris sequel)*..... 22.
4283 ■ Falcon/AT *(F-16 simulation)* ..... 32.

Stone & Assoc. ... NCP

3435 ■ My Letters, Numbers, Words *(2 to 6)* 22.
3439 □ 2nd Math *(ages 7 to 16)*..... 27.

Sublogic ... NCP

3335 □ Jet *(requires CGA or EGA)* ..... 33.
6190 □ Air Transport Pilot..... 33.

True BASIC, Inc. ... NCP

■ Kemeny/Kurtz Math Series:
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Manufacturer's standard limited warranty period for items shown is listed after each company name. Some products in their line may have different warranty periods.

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AST Research ... 2 years

1223 I/O Mini 2 C/S/P ..... 89.
1299 SixPakPlus 384k C/S/P ..... 189.
4107 RAMpage Plus 286 512k..... 419.

Brother International ... 1 year

5787 HL-8e Laser Printer..... 1899.
5788 HL-8Ps PostScript Laser Printer ... call
5786 Toner/Drum Kit ..... 99.

Compucable ... 2 years

1604 2-Position switch box ..... 25.
1605 3-Position switch box ..... 35.

Cuesta ... 1 year

1608 Datasaver 400 Watt *(power backup)* 429.

Curtis ... lifetime

1689 Diamond ..... 29.
1690 Diamond Plus..... 41.
1694 Emerald SP-2 ..... 36.
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1708 Ruby-Plus SPF-2 Plus *(w/FAX & modem protection)* ..... 65.

Diconix ... 1 year

5655 150 Plus Printer *(Parallel)*..... 359.

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We are an authorized Epson Service Center.

1906 FX-850 *(80 col., 264 cps, 9 pin)* ... call
1904 FX-1050 *(136 col., 264 cps, 9 pin)*.. call
5183 LQ-510 *(80 col., 180 cps, 24 pin)*.. 349.
1930 LQ-850 *(80 col., 264 cps, 24 pin)* .. call
4117 LQ-950 *(110 col., 220 cps, 24 pin)*.. call
1917 LQ-1050 *(136 col., 264 cps, 24 pin)* call
4116 LQ-2550 *(136 col., 333 cps, 24 pin)* call
5184 LX-810 *(80 col., 180 cps, 9 pin)* ... 199.
1052 Printer-to-IBM cable *(6 feet)*..... 15.

5th Generation ... 1 year

3952 Logical Connection 512k..... 529.

Hayes ... 2 years

2304 Smartmodem 1200 ..... 289.
2307 Smartmodem 2400 ..... 429.
2308 Smartmodem 2400B *(w/Smartcom II)* 429.

Hercules ... 2 years

2318 Graphics Card Plus..... 189.
5120 VGA Card..... 189.

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☐ *Ami Professional 1.0*–Windows-based word processor for high-powered office automation tasks. Includes mail merge, macros, thesaurus, professionally designed style sheets, and integrated drawing and charting capabilities. . **$319.**

Intel ... 5 years

4696	2400B Internal Modem	159.
2352	2400B Internal Modem 2 *(for PS/2)*	249.
5119	2400 Baud External Modem	179.
2346	Inboard 386/PC w/1 Meg	579.
4266	Above Board Plus 512k	419.
4267	Above Board Plus I/O 512k	449.
5336	Above Board Plus 8 2 Meg	699.
5342	Above Board Plus 8 I/O 2 Meg	739.
4272	Above Board 2 Plus 512k	469.
4275	Connection Coprocessor	769.
	MATH COPROCESSORS	
2370	80287-8 *(for 8 MHz 80286 CPU's)*	199.
2369	80287-10 *(for PS/2 Models 50 & 60)*	229.
4750	80387SX *(for 80386SX CPU's)*	309.
2371	80387 *(for 16 MHz 80386 CPU's)*	349.
2372	80387-20 *(for 20 MHz 80386 CPU's)*	399.

Kensington Microware ... 1 year

2582	Masterpiece Plus	109.
5697	Expert Mouse *(Trackball for PS/2)*	115.

Key tronic ... 3 years

4518	101 Plus Keyboard	99.

Kraft ... 5 years

5801	New Game Adapter *(2 game ports)*	27.
5800	3 button Thunder Joystick	29.
5802	Trackball	69.

Logitech ... limited lifetime

5464	Series 2 Mouse *(C9 for PS/2's)*	65.
5151	HiREZ Mouse *(C9)*	79.
6029	Trackman *(Trackball) serial* 85. *bus*	89.
4297	ScanMan Plus *(hand scanner)*	185.

Magnavox ... 2 years

5990	13" VGA Monitor *(CM9032)(1 yr. wrnty.)*	349.
4761	13" VGA Monitor *(9CM062)*	389.

Micron Technology ... 2 years

5818	Beyond 640 EMS Board 1 MB *(exp. to 8 MB w/daughter card)*	369.
5821	Beyond EX Extended Memory Board 2 MB *(exp. to 4 MB w/daughter card)*	599.
6005	Ascend Memory Board for Compaq *(4 Meg)*	729.

Microsoft ... lifetime

2897	Mouse with Paintbrush	109.
2898	Mouse with Windows 286 2.1	139.

MicroSpeed ... 1 year

6007	PC-TRAC Trackball *serial* $75. *bus*	$85.
6010	FastTRAP 3D Trackball *serial* 99. *bus*	109.

Mouse Systems ... lifetime

5994	OmniMouse II w/PC Paint Plus	49.
5845	White Mouse *(bus or serial)*	69.
5997	Trackball *serial* 75. *bus*	85.
4306	PC Mouse II w/PC Paint+	89.

NEC ... 2 years

4799	Multisync 2A *(VGA Monitor)*	499.
5085	Multisync 3-D Monitor	689.

Orchid Technologies ... 4 years

3069	Tiny Turbo 286 *(accelerator board)*	219.
5105	ProDesigner VGA Plus *(800 x 600)*	249.

PC Power & Cooling Sys. ... 1 yr

	REPLACEMENT POWER SUPPLIES	
3202	Turbo Cool 150 *(25° - 40° cooler)*	129.
3205	Turbo Cool 250 *(25° - 30° cooler)*	169.
3200	Silencer 150 *(84% noise reduction)*	115.

Practical Peripherals ... 5 years

3101	1200 Baud Internal Modem	69.
3100	1200 Baud External Modem *(mini)*	77.

Intel ... 5 years
2400 bps Modems–Reliable connections, 100% Hayes compatibility, and a great price.
2400EX (external) ..... $179.
2400B Classic (internal) ..... $159.
2400B Modem 2 (internal microchannel) ... $249.

3103	2400 Baud Internal Modem	139.
3102	2400 Baud External Modem	179.
5285	2400 Baud Ext. MNP Modem *(Lev. 5)*	209.
4542	2400 Baud Internal Modem for PS/2	229.

Safe Power Systems ... 2 years

4561	Safe 250W *(standby power bkup)*	249.
4562	Safe 425W *(standby power bkup)*	369.

SOTA Technology ... 2 years

5107	Floppy Drive Controller *(S/P)*	99.
5111	SOTA 286i-12 *(12 MHz accelerator)*	299.
5402	SOTA 386i-16 *(16 MHz accelerator)*	419.

Targus ... lifetime

4899	Nylon Laptop carrying case	55.
4901	Premier leather carrying case	199.

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☐ *Air Transport Pilot*–Fly a Boeing 737, 747, 767 or Airbus A300 airliner. Includes 350 U.S. cities, automatic weather generation, Air Traffic Control feedback, airborne traffic, multiple flight modes, and more ..... **$33.**

TheComplete PC ... 2 years

5598	TheComplete Half Pg. Scanner 400	189.
4887	TheComplete FAX 9600	429.
5140	TheComplete Page Scanner	549.

Toshiba ... 1 year

3684	T1000 Laptop *(80C88, 6.4 lbs.)*	669.
4958	T1600 Laptop *(12 MHz, 20 Meg)*	3249.

Tripp Lite ... 2 years

6019	LS 600 Line Stabilizer	85.

Video 7 ... 7 years

3778	VEGA VGA	259.
5883	1024i VGA *(includes 512k)*	289.

DRIVES

IOMEGA ... 1 year

5116	Bernoulli II Single 44 Meg Internal	995.
5117	Bernoulli II Dual 44 Meg External	1969.
5113	44 Meg Cartridge Tripak *(5¼")*	249.
2499	PC2 Card *(controller required)*	169.
2500	PC2B Card *(bootable card)*	229.

Konami/Ultra Software ...CP
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5500	80-152M Int. Tape Drive	629.
6153	DC2120 Cartridge *(5 pack)*	135.
5190	DC2000 Pre-formatted Cartridges ea.	35.

Pacific Rim ... 1 year

5010	1.2 Meg External *(for PS/2's)*	215.
5011	360k External 5¼" Drive	179.

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3105	Hardcard 20 Meg *(49 ms)*	549.
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Seagate ... 1 year

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2286	30 Meg Internal Hard Drive ST238 *(w/controller and cables, 65 ms)*	299.
4554	40 Meg Int. HD ST251-1 (28 ms)	359.
2287	40 Meg Int. HD for PC ST251-1 *(w/controller and cables, 28 ms)*	429.
4624	80 Meg Int. HD ST4096 (28 ms)	619.

MicroSpeed ... 1 year

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TEAC ... 1 year

4950	PC, XT 360k Drive *(5¼")*	79.
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4670	1.44 Meg Drive for XT *(3½")*	99.
4326	1.44 Meg Drive for AT *(includes Bastech software utilities, 3½" copy prot.)*	119.

Toshiba ... 1 year

3649	AT 1.2 Meg Drive *(5¼")*	99.
4755	AT 1.44 Meg Drive *(3½", includes Bastech software utilities)*	119.

MISCELLANEOUS

CompuServe

1676	CompuServe Information Service	24.

Cables ... lifetime

1019	Smartmodem-to-AT cable *(10 feet)*	15.
5511	Right Angle Printer cable *(6 feet)*	15.
1050	Parallel Printer cable *(15 feet)*	19.

DISKS

All disks have a lifetime warranty.

5¼" DS/DD Disks *(360k)*

3291	Sony *(10 disks per box)*	$12.
2789	Maxell MD2-D *(10 disks per box)*	13.
4192	Verbatim Datalife *(10 disks per box)*	13.

5¼" DS/High Density Disks *(1.2 Meg)*

3770	Verbatim Datalife *(10 disks per box)*	19.
3292	Sony *(10 disks per box)*	19.
2790	Maxell MD2-HD *(10 disks per box)*	19.

Practical Peripherals ... 5 years

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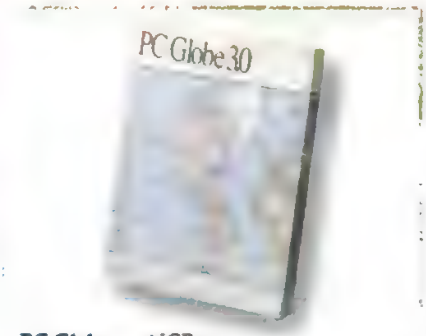

PC Globe ... NCP

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3297	Sony *(10 disks per box)*	14.
3772	Verbatim *(10 disks per box)*	15.
2792	Maxell *(10 disks per box)*	15.

3½" DS/High-Density Diskettes *(1.44 Meg)*

3298	Sony *(10 disks per box)*	29.
3773	Verbatim *(10 disks per box)*	29.
2793	Maxell *(10 disks per box)*	29.

MEMORY

3248	256k DRAMs *(120 nanosecond)*	call
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5746	1 Meg Chips *(80 nanosecond)*	call

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- For monitors, printers, Bernoulli Boxes, computers, hard drives, and power backups, actual UPS Blue charge will be added. For all other items, add $3 per order.

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- Call 603/446-3383 for information.

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ENDURANCE TESTS

386 PCs

Northgate Elegance 386/25

by Robert W. Kane

If King Kong had been as resilient as the Northgate Elegance 386/25, he'd be on top of the Empire State Building today. This monster of a machine has withstood Federal Express shipments, road trips in my car, and the occassional (accidental) drop. But, like John Cameron Swayze's favorite watch, it keeps right on ticking.

Housed in what is perhaps the most rugged and attractive tower case on the market, the 80386 CPU runs at 25 MHz with 256K of read/write cache. As tested, the $10,153 Elegance contained 4MB of RAM, an 80387 coprocessor, a 16-bit VGA controller and a 600MB SCSI drive. This combination of speed and capacity was enough to handle my day-to-day word processing, spreadsheet, and graphics applications with aplomb.

While this machine can hardly be touched for sheer performance, the Elegance is usually dependable but plagued by a few hiccups when it comes to reliability and compatibility.

For instance, if you choose to bypass the power-up self test (POST), the 600MB hard disk doesn't have a chance to come up to operational speed and will not boot the system. The solution: don't bypass the memory test.

Then there was the time that I returned after a trip to find that the POST would count memory only up to 128K. After methodically removing and reseating the SIMMs, the ROM, and the cache memory, I finally pressed firmly on the 80386 chip, which brought the Elegance back to life. I surmised that this action flexed the motherboard, allowing whatever had come loose to make contact. Northgate commented that earlier versions of the motherboard had SIMM sockets that, if not carefully installed, would short out the memory modules.

Compatibility testing also revealed some bugaboos. I was unable to get a QMS JetScript add-in board to work. *Lotus Express* locked up the system every time I attempted to load it. While I was unable to come up with a solution to the former problem, the latter was solved by running *Express* in a window under *Microsoft Windows/386*.

However, these are minor points given the Elegance's favorable overall performance. Its sensible design combined with superior components make this machine well suited for the long haul.

Northgate Elegance 386/25
Northgate Computer Systems Inc., P.O. Box 41000, Plymouth, MN 55441; (800) 548-1993.
List Price: With 4MB RAM, 600MB SCSI hard disk, 1.44MB 3.5- and 1.2MB 5.25-inch floppy disk drives, 16-bit VGA controller and Princeton 14-inch monitor, 80387 coprocessor, 256K cache, $10,153.
CIRCLE 403 ON READER SERVICE CARD

NORTHGATE ELEGANCE 386/25

Last review: May 30, 1989; page 248
Reason selected: Editor's Choice
Positive findings: Rugged character, excellent price/performance ratio.
Negative findings: The long wait for the hard drive to spin up to operational speed at boot time.

RELIABILITY
COMPATIBILITY
PERFORMANCE

Tandy 5000MC

by Rock Miller

When it first came out, the Tandy 5000MC seemed to combine the emerging standard of the future with the advantages of the past, including support for 5.25-inch drives. But now that the furor over the Micro Channel bus has cooled somewhat, the machine must be judged on the more basic criteria of performance, compatibility, and reliability over the long term. In this light, it looks somewhat less attractive.

The $7,628 review unit came equipped with 4MB of RAM; overall, the machine is solidly designed and built, especially the superb Tandy keyboard. The lack of a disk activity light on the front panel is annoying, though, particularly since the speedy 80MB hard drive is so quiet. And the Tandy VGM-300 VGA monitor was far from impressive: in text mode, it was dimmer and harder to read than my old NEC MultiSync, and it tended to blur on high-resolution graphics screens.

Switchless installation worked as advertised but was needlessly complicated by the stupidity of the setup program that Phoenix supplies with its MCA chip set. Backing up the Reference Disk, for example, requires a 720K diskette, a tip that is not documented. In fact, Tandy's documentation is just about useless for getting you up and running: it intermixes information for all of Tandy's 286 and 386 models, so instructions specific to the 20-MHz 5000MC are hard to find.

TANDY 5000MC

Last review: May 30, 1989; page 286
Reason selected: Editor's Choice
Positive findings: Solid construction, an excellent keyboard.
Negative findings: Prone to system lockups and conflicts; dim and blurry monitor.

RELIABILITY
COMPATIBILITY
PERFORMANCE

The 5000MC held up well enough in daily use but did seem to suffer from more than a normal share of lockups and compatibility problems. The power-on self test registered a bad serial port whenever another computer was attached over a serial cable. And Tandy's TEMM.SYS expanded memory emulator conflicted with the 5000MC's serial ports; consequently my file transfer programs gave numerous timeout errors or failed to work at all when it was installed.

Though the 5000MC isn't a bad machine, it's hard to see what it has to offer over the competition, especially with the premium that Tandy must charge for the Micro Channel bus. You'd probably be better off going elsewhere if you must have a Micro Channel computer.

Tandy 5000MC
Tandy Corp., 1800 One Tandy Center, Fort Worth, TX 76102; (817) 390-3011.
List Price: With 4MB RAM, 80MB ST-506 hard disk, 1.44MB 3.5-inch floppy disk drive, VGM-300 monitor, $7,628.
CIRCLE 404 ON READER SERVICE CARD

Zenith Z-386/25

by Jennifer Zaino

I must admit to a certain fondness for the Zenith Z-386/25. The $9,298 machine, a market leader by virtue of federal government contracts, didn't get Editor's Choice

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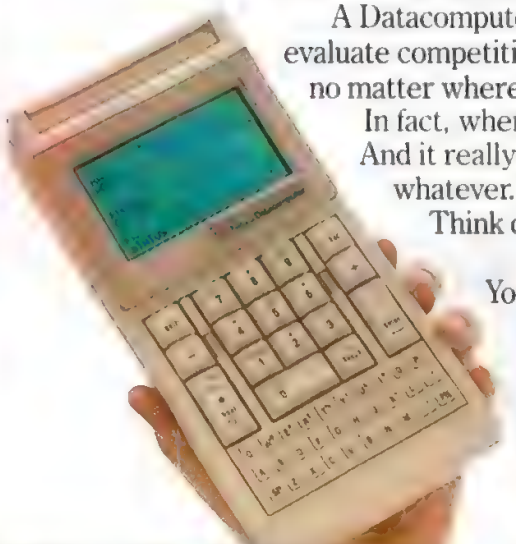

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ZENITH Z-386/25

Last review: May 30, 1989; page 316
Reason selected: Market leader
Positive findings: Problem-free setup, clicky keyboard, excellent display, roomy hard disk.
Negative findings: Some sloppy construction, forever-enabled shadow RAM, and the awkward placement of some keyboard keys.

↑	RELIABILITY
—	COMPATIBILITY
↑	PERFORMANCE

in our 386 blockbuster, but it has captured a place in my heart. Like any couple, we've had problems; still, I'll be saddened by its departure.

Things were rosy at first. Setup was simple: all I had to do was install Zenith DOS 3.3 Plus on the preformatted 150MB hard disk. Although the machine's benchmark-test results didn't bowl us over when last reviewed, the speed boost over my 286 left me giddy. And the keyboard's solid clickiness immediately entranced me.

Then I started noticing small flaws. On the keyboard, the Backslash is awkwardly situated beneath the Enter key; I got used to it, but was confused whenever I moved to a more traditional keyboard. And although Zenith's enhanced version of DOS lets you create partitions greater than 32MB, the way it stores drive table information gives programs like *PC Tools Deluxe* and *The Norton Utilities Advanced Edition* 4.5 problems when performing some hard disk operations.

Other, more-serious, difficulties threatened to disrupt the relationship. Removing the system's cover revealed sloppiness: some slot covers overlapped, making it challenging to unscrew them, and the speaker wires climbed over the top of the I/O card, increasing the risk of accidentally disconnecting them when replacing the cover. Once, after I closed the box, *XyWrite* didn't beep for a week, no matter how many errors I made.

I was disheartened to find that the shadow RAM cannot be disabled. PC Labs has found that some software won't run on some systems with BIOS shadowing, although I had no trouble.

Occasionally, I had to compromise. Take the time I discovered that the additional 5.25-inch drive that Zenith sent me doesn't fit beneath the standard 3.5-inch floppy: it sits in the bay usually associated with drive A:, and I often mistakenly tried to access it as such. The only way to designate the 5.25-inch unit as A: is with the DOS ASSIGN command.

The good times made up for a lot, though: problem-free multitasking with *Microsoft Windows/386*, the successful substitution of an 8-bit video board for the 16-bit card; the happy installation of Intel's Connection CoProcessor; the joy of Zenith's FTM display . . . .

Saying good-bye won't be easy. I just hope my Zenith remembers to write.

Zenith Z-386/25
Zenith Data Systems, 1000 Milwaukee Ave., Glenview, IL 60025; (800) 842-9000.
List Price: With 2MB RAM, 150MB hard disk, 1.44MB 3.5- and 1.2MB 5.25-inch floppy disk drives, DOS 3.3 Plus, Zenith flat-screen monitor, $9,298.

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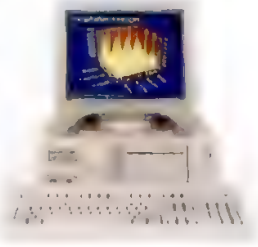

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ENDURANCE TESTS

386 PCs

Zeos 386-20

by Donald P. Willmott

The Zeos 386-20 arrived at my office soon after it was named an Editor's Choice in *PC Magazine*'s roundup of 386s (May 30, 1989). Six months later, we don't have to change our minds. The half-year road test has been a pleasant trip.

The full-size, eight-slot system, which offers only three externally accessible drive bays, came with a 65MB Seagate hard disk, 2MB RAM with 64K static RAM cache, and a 14-inch Tatung VGA monitor. Its May 1989 price of $4,483 has dropped to $4,012, and the machine now includes Zeos's own monitor.

The machine has been compatible with everything I've thrown at it, and peripheral installations have been painless. Among other things, I installed a bus version of the Microsoft mouse quickly and without conflict. I replaced an external 1,200-bit-per-second Hayes modem with an internal 2,400-bps Hayes modem—no surprises there, either. *Microsoft Windows/386* also runs without glitches.

The Taiwanese NTC Company's 101-key keyboard has a pleasingly discernable click, but its best feature is its compact footprint. Just 6.5 inches deep, it's an inch or so narrower than most others; this means a real savings in desktop space.

One point for Zeos to ponder: it shouldn't bother with digital readouts showing clock speed. The Zeos's is big and green, but if you don't do a lot of downshifting, all it's ever going to say is "20."

Two other minor complaints have popped up over the months. The spring device that ejects floppy disks from the drive stopped springing soon after the machine arrived. When you flip the lever, the disk doesn't pop out; it just sits there.

The 230-watt power supply is a bit noisier than you may be used to tolerating, especially if you're upgrading from a 286 (more power, more heat, bigger fan). Sometimes the fan rattles, but a nice firm slap usually quiets things down. Aside from minor quibbles like that, the Zeos 386-20 has proved itself to be a worthy Editor's Choice over the long run.

Zeos 386-20
Zeos International Ltd., 530 5th Ave. NW, St. Paul, MN 55112; (800) 423-5891, (612) 633-4591.
List Price: With 2MB RAM, 65MB hard disk, 1.2MB 5.25-inch floppy disk drive, ATI Wonder VGA card, Zeos VGA monitor, DOS 3.3, $4,012.

CIRCLE 406 ON READER SERVICE CARD

ZEOS 386-20

Last review: May 30, 1989; page 318
Reason selected: Editor's Choice
Positive findings: Unfailingly effective and efficient; slim keyboard is a real desktop space saver
Negative findings: Limited number of externally accessible drive bays.

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COMPATIBILITY
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CIRCLE 265 ON READER SERVICE CARD

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PC MAGAZINE EDITORS' CHOICE
Oct. 11, 1988
Dataworld Portacomp

"The Portacomp II is a value leader with fast memory, a fast drive controller and a terrific keyboard. Marvelously cheap powerful alternative... outperformed the other 286's."

PC MAGAZINE EDITORS' CHOICE
May 30, 1989
Dataworld Data 386-20

Dataworld's DATA 386-20 and DATA 386-25 stand out in the 20- and 25-MHz categories for speed and quality construction."

PC MAGAZINE EDITORS' CHOICE
May 30, 1989
Dataworld Data 386-25

"The Dataworld Data 386-20 minitower and Data 386 full-size tower are good values and first-rate performers from an up-and-coming mail-order firm."

PC MAGAZINE EDITORS' CHOICE
Feb. 28, 1989
Dataworld Data 386-16

"The Dataworld offers a 16-bit video system with a top-quality NEC Multisynch monitor and an exceptionally fast disk-drive controller for an impressive combination of value and performance... from a vendor with an increasing reputation for quality." 16 MHz system."

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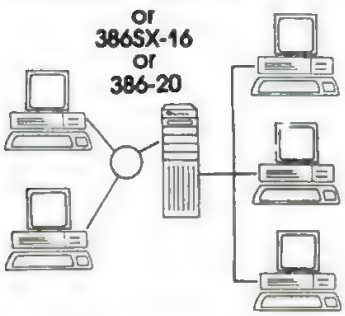

DATA 386-20

STANDARD CONFIGURATION

- Intel 80386-20 microprocessor
- 1MB base memory RAM
- 16-bit extended VGA card. 512K capable of 1024×768 with 16 colors
- NEC Multisync 3D capable of 1024×768 interlaced
- 43MB, 25ms hard disk
- 1.2MB or 1.44MB drive
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DATA 386-25

STANDARD CONFIGURATION

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- 1MB base RAM, expandable to 16 MB of 32-bit memory
- LIM EMS 4.0 driver supplied
- Intel 82385 cache controller 64K of static RAM cache (2-way set associative)
- 16-bit extended VGA card. 512K capable of 1024×758 with 16 colors
- NEC Multisync 3D capable of 1024×768 interlaced
- 1.2MB or 1.44MB drive
- 1 32-bit, 5 16-bit, and 2 8-bit
- 230W power supply
- 1 parallel and 2 serial ports

AVAILABLE OPTIONS

- Full-size vertical case
- RAM upgrades to 2, 4, 5, or 8MB using DIPs and/or SIMMs
- 20MB to 300MB hard drives with MFM, RLL, SCSI, or ESDI interface
- 40-120MB tape backup drive
- Available in standard monochrome (720×348, amber), standard VGA (640×480, color) or extended VGA (800×600 up to 1024×768, color)

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BASE CONFIGURATION W/40MB DRIVE (VGA GAS PLASMA)

- Intel 80386SX-16 CPU
- VGA gas plasma display, 640×480 resolution with 16 levels of grey
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- 1MB of base RAM, expandable to 5MB with memory daughterboard
- AMI BIOS with ROM setup and diagnostics
- Expansion slots: 1 half-length slot available
- 1.44MB diskette drive (External 1.2MB drive connector port built-in)
- 40MB, 25ms hard drive (IDE interface)
- 1 parallel and 2 serial ports
- 87-key keyboard (external keyboard connector port built-in)
- 65W power supply
- Carrying case
- Weight: approx. 15lbs.

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- 80387SX coprocessor socket
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Compaq SLT/286

by Bill Howard

Not the cheapest or lightest 286 battery-powered portable, the $8,116, 14-pound Compaq SLT/286 deserves at least one superlative: the best in my book. Based on six-months'-plus experience, it is obvious that the 12-MHz SLT—complete with 2.6MB RAM, 40MB hard disk, 2,400-bit-per-second modem, and incremental powerdown—has the all-around balance and passable power that allows one machine to be both a desktop and a portable.

You can attribute the high price partially to the fact that the company refused to compromise in areas where other vendors might, taking the more functional, more powerful—and more expensive—route in almost every case. You get quick recharge (2 hours) and lightweight, quick-change batteries ($129); a reasonably bright VGA display; a front-loading floppy disk drive; and a sub-30-millisecond hard disk.

While some of these options might at first seem like excess dressing, not one is a minor consideration over the long term. If this is going to be your only machine, you'll want the best display you can get. And while other systems boast faster CPU times, this is one of the few portables whose hard disk can pretty much keep up with the speed of my desktop machine.

Power consumption is intelligent. Under continual use, I found that the SLT/286 delivered about 2.5 hours per charge. When left on and unattended, it settled into a self-preserving shell that extended standby life (and preserved my unsaved data) for many days. On coast-to-coast flights, I was able to simply set the machine aside during dinner, which is more convenient than saving files, shutting down, and booting up again.

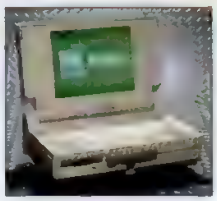
The 5- by 8-inch display is about as good as today's technology can offer, although I still wished for a bit more contrast and brightness. Graphical applications always seemed brighter and crisper than character-only apps.

After using a laptop with a detachable keyboard, I'm spoiled for life. However, you'll probably be annoyed by the lack of dedicated Home, PgUp, PgDn, and End keys; I was. But that's the biggest compromise in an otherwise excellent machine.

Compaq SLT/286
Compaq Computer Corp., 20555 SH 249, Houston, TX 77070; (800) 231-0900.
List Price: With 2.6MB RAM, 40MB hard disk, 1.44MB 3.5-inch floppy disk drive, 2,400-bps modem, DOS 3.3, $8,116.

CIRCLE 407 ON READER SERVICE CARD

COMPAQ SLT/286



Last review: July 1989; page 98
Reason selected: Editor's Choice
Positive findings: Convenient detachable keyboard, brand-name dependability.
Negative findings: Spacious VGA screen could be brighter; keyboard lacks dedicated cursor keys; price is too high.

RELIABILITY ▲
COMPATIBILITY ▲
PERFORMANCE —

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MicroWay is your best source for the software and hardware you need to get true 32-bit performance from your 386. Our NDP C compiler takes the original C concept of writing lower level code with a higher level language to the limit. We provide an inline assembly language interface that lets the programmer specify the exact register used to hold a variable. This feature makes it possible to use ports or perform interrupts or block moves inline, instead of through calls. The use of register aliased variables to control hardware reduces the size of critical code sequences by a factor of 3 to 10 and keeps the 386's pipelines full by eliminating costly calls. If you are interfacing DOS or the ROM BIOS, writing graphics routines, an operating system kernel, a device driver, or an embedded application, you owe it to yourself to try NDP C-386.

NDP C is also the language of choice if you are combining C with FORTRAN or Pascal, are planning to use any one of four coprocessors that run with the 80386, or require the best globally optimized code attainable. MicroWay's C, FORTRAN and Pascal compilers come with a 70 function, device-independent graphics library that automatically supports Monochrome, Hercules, CGA, EGA, and VGA adapters and makes it easy to interface memory-mapped peripherals such as digitizers or serial devices. Finally, our C is not only one of the easiest to use, but supports two dialects. ANSI and UNIX. Ithaca Software reports "We ported HOOPS, with over 100,000 lines, without a hitch, in less than a day! NDP C-386 was the fastest 386 compiler we used...It also offers the enormous advantage of Weitek support."

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386 Compilers and Tools

NDP C++ is a MicroWay port of the UNIX C++ preprocessor version 1.2. It runs in protected mode on DOS, UNIX or XENIX, and is ideal for writing numerics and graphics applications. The product comes with an example of how to support complex numbers in C++ $495

NDP Fortran-386™, **NDP C-386™**, and **NDP Pascal-386™** compilers generate globally optimized, mainframe quality code that runs on the 386 or 486 in protected mode under UNIX, XENIX or Phar Lap extended DOS. The compilers address 4 gigabytes of memory while supporting the 80287, 80387 and Weitek coprocessors. Applications can mix code from all three compilers and assembly language. The DOS versions allow the user to write his own numeric error handlers and interface 386 real mode programs from protected mode. The VM versions use Phar Lap's Virtual Memory Manager to run programs which exceed the size of your system memory. **NDP Fortran-386** is a full FORTRAN 77 with FORTRAN 66, BSD 4.2, DOD and VMS extensions. **NDP C-386** is a full K&R C with both MS and ANSI extensions. It is 100% compatible with UNIX C and is substantially faster than the C which comes with UNIX. **NDP Pascal-386** is a full ANSI/IEEE Pascal, with extensions from C and BSD 4.2 Pascal.

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CIRCLE 223 ON READER SERVICE CARD

NEC UltraLite

by Bill Machrone

After living with the $2,999 NEC UltraLite for a year, I'm hopelessly addicted to its size, weight, and convenience. I'm not as fond of the 2-hour battery life, but the revised version that came out in September sports replaceable batteries. The new version also adds a vastly improved screen that's far less reflective than the original, which gave me a clear view of my necktie. In fact, the screen is so much brighter that I always run it at half power, which extends battery life considerably.

NEC has also improved the keyboard. The original occasionally failed to register your keypresses, especially if you hit a key off-center. The new one is far more forgiving and more pleasant for typing.

The recently introduced ROM cards are a boon. Memory burners like Lotus Development Corp.'s *Agenda* and *Lotus Express*, as well as XyQuest's *XyWrite* (with its spelling dictionary), are at your fingertips and don't burden the silicon drive. In addition, programs load twice as fast from the ROM card as they do from the already-speedy silicon disk.

I'd like to meet the person at Microsoft who convinced NEC to waste 150K of precious system ROM on the DOS Manager shell. About 8K worth of *PC Magazine* utility programs do the same job better. That single instance aside, I have yet to hook a floppy disk to the UltraLite. With Traveling Software's *LapLink* in ROM, data transfer is convenient—just a serial cable's length away. So are painless backup duties and getting files in agreement among my home, office, and travel machines.

You'd never use the UltraLite as your only machine, and having another PC renders the laptop's optional external floppy nearly superfluous. I do, however, miss the system's parallel port, which requires the floppy adapter. Occasionally, I'd just like to hook the UltraLite to a printer instead of having to transfer files to a desktop machine to get hard copy.

Perhaps the most important thing to note is that my UltraLite has been utterly reliable, as have several others in use here at *PC Magazine*. One of our vice presidents, however, has had two earlier models expire. (NEC replaced them without question.)

Sure, I can think of a dozen small ways to improve the UltraLite, but on the whole it remains an engineering tour de force—and my road machine of choice.

NEC UltraLite

NEC Home Electronics (U.S.A.) Ltd., 1255 Michael Dr., Wood Dale, IL 60191; (312) 860-9500.

List Price: With 640K RAM, 2MB silicon hard disk, 2,400-bps internal modem, *LapLink* Version NU 2.01 (in ROM), DOS 3.3, DOS Manager, $2,999. Optional external floppy disk drive, $399. Additional batteries (for upgraded version), $119.

CIRCLE 406 ON READER SERVICE CARD

NEC ULTRALITE

Last review: October 17, 1989; page 256
Reason selected: Technical Excellence award, 1988
Positive findings: Small size and low weight—you won't throw your back out lugging it through the airport.
Negative findings: Bnef battery life.

RELIABILITY: ↑
COMPATIBILITY: —
PERFORMANCE: ↑

Toshiba T1000

by Rock Miller

As the first full-fledged DOS-based PC to come in a briefcase-size package, the Toshiba T1000 was a milestone when it was introduced two years ago. This Model T of laptop machines has worn extremely well in the year and a half I've had it, proving a reliable companion at home and on the road.

With DOS 2.11 in ROM and the 768K expansion memory board configured as a battery-backed RAMdisk (an absolute necessity), the T1000 is practical for most basic tasks. Provided you pick your programs carefully and erase any extraneous files, you should have enough room on the RAMdisk for one major application (such as a word processor or spreadsheet) plus a communications program and a few utilities, leaving the floppy drive free for data disks.

In practice, though, I often keep my current data files on the RAMdisk, too. By avoiding floppy disk access, I can nurse a full three and a half hours out of a single charge. Even after the low-battery light goes on, there's still plenty of time to get to a power outlet. On a full battery, the RAMdisk stays alive for two weeks or more without recharging.

Though the nonbacklit supertwist LCD display is surprisingly readable—considering its squashed profile and picky ergonomics—it does give you the squints after a while. And I've always been puzzled that Toshiba chose to put such a dinky keyboard in a machine whose audience is made up heavily of writers, particularly when I look enviously at the terrific keyboards that users of Toshiba's other laptops enjoy.

Still, this back-to-basics design approach means there's less to go wrong, and Toshiba's exemplary mail-in warranty service makes it even more dependable. In both instances that I've had a problem (once with a floppy disk drive knocked out of alignment, and once with dead batteries), Toshiba's technical support people in California identified the trouble quickly and got the machine back to me within a week. The first time, they even upgraded my ROMs at no charge.

The T1000 does seem poky, especially next to its flashier competition. But with the street price of a base model now down below $700, it's an unbeatable bargain. If it meets your needs, you won't go wrong with it.

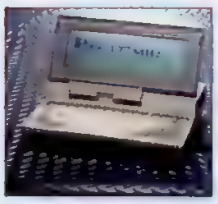
Toshiba T1000

Toshiba America Information Systems Inc., Computer Systems Division, 9740 Irvine Blvd., Irvine, CA 92718; (800) 334-3445.

List Price: With 512K RAM, 720K 3.5-inch floppy disk drive, *PC-Kwik PowerPak* utilities, DOS 2.11 (in ROM), $999. 768Card expansion memory card, $399.

CIRCLE 409 ON READER SERVICE CARD

TOSHIBA T1000



Last review: October 17, 1989; page 274
Reason selected: Market leader: Best of 1987
Positive findings: Low weight; extremely practical for light-duty computing; excellent company support.
Negative findings: Poor display, unappealing keyboard, unimpressive speed

RELIABILITY: ↑
COMPATIBILITY: ↑
PERFORMANCE: —

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PC MAGAZINE
EDITOR'S CHOICE
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March 28, 1989

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Toshiba T1600

by Salvatore P. Ricciardi

When it comes to laptops, I'm a power seeker. After six months with the $4,999 Toshiba T1600, I still get the kick I need thanks to its 12-MHz 286 processor, speedy hard disk, and super keyboard.

The 27-millisecond hard disk is consistently speedy and quiet, although I did fill up its 20MB in no time. (The system is now also available with a 40MB disk.) In terms of performance, the 286 processor, together with the fast disk and optional caching software, yield very respectable turnaround. This machine *feels* fast.

The keyboard is easily the best I've seen on any laptop. It's light to the touch, responsive, not too crowded, and—thank goodness—has dedicated cursor movement and paging keys. You won't find yourself cursing function key madness a few months down the line.

Its EGA display seems something of a compromise. After all, VGA technology is available and in use in some competitive machines, like the Compaq SLT/286. But Toshiba did something right with this display: it's bright and very readable, almost all of the time. You won't find yourself toying with the controls nearly as much on this machine as you would on some other laptops. If you don't need the VGA's extra pixels, this screen should please you.

One problem with the display is that the system fonts are sleep inducing. I solved this annoyance with Personics Corp.'s excellent *UltraVision* and its SANS2 font.

The one real disappointment with the 12-pound T1600 reveals itself the first time you find yourself without AC power. With the standard one battery installed, you can expect to get less than an hour of battery life. With the optional second battery installed—which adds one pound to the weight and $129 to the price—I found that the T1600 rarely delivered more than 1.5 hours of power. On coast-to-coast flights, I find this limiting.

Other than this admittedly annoying problem, the T1600 is an enduring—and endearing—machine that remains a favorite after extended usage.

Toshiba T1600
Toshiba America Information Systems Inc., Computer Systems Division, 9740 Irvine Blvd., Irvine, CA 92718; (800) 334-3445.
List Price: With 1MB RAM, 20MB hard disk, 1.44MB 3.5-inch floppy disk drive, DOS 3.3, $4,999.

CIRCLE 410 ON READER SERVICE CARD

TOSHIBA T1600

Last review: July 1989, page 123
Reason selected: Market leader
Positive findings: First-class keyboard, readable and bright display (albeit EGA).
Negative findings: Annoyingly brief battery life, sleepy screen fonts.

RELIABILITY
COMPATIBILITY
PERFORMANCE

CIRCLE 149 ON READER SERVICE CARD

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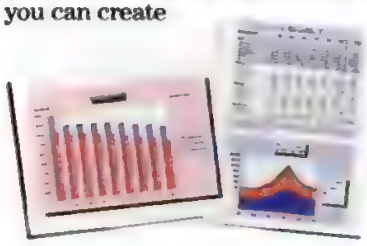

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CIRCLE 263 ON READER SERVICE CARD

Zenith SuperSport 286

by Bill Howard

Too much sun makes you old before your time. Too much competition does the same to portable PCs. Case in point is the Zenith SuperSport 286, a dazzling machine when introduced in the spring of 1988—and Technical Excellence Award finalist that fall. The SuperSport's stats used to stand out. Now they're commonplace: 12-MHz 286 processor; 27-millisecond, 40MB hard disk; 8- by 6-inch screen.

My impression after a year and a half with a 20-pound Zenith carry bag weighting me down at DFW, EWR, ORD, and SEA? A solid citizen that has spent too much time in the sun. It needs the computer equivalent of a facelift and liposuction.

Mind you, this isn't a terrible machine. I've traveled with several SuperSport 286 units. They've always been rugged; none failed. But now I find that when I need to carry serious computing power around—"serious" meaning a 286 or 386SX, a hard disk, and the ability to drive an external color monitor—I'm more likely to pick a Compaq SLT/286, NEC ProSpeed 286, or Toshiba T1600. The SuperSport is chunkier and heavier than the competition, and it suffers, badly, from a CGA display when everyone else has VGA or EGA. (In fall of 1989, Zenith fixed this problem by adding a VGA version to the lineup.)

Generally, Zenith's keyboard deserves kudos for its solid feel. However, it lacks dedicated Home, PgUp, PgDn, and End keys, and I never got used to the Ctrl-key combinations that take their place. The maximum of 2MB of memory is also a limitation: you should have space for 4MB to 5MB. Even on the road, I sometimes found myself wishing for extra RAM; that way, I could have accommodated very large *Lotus 1-2-3* spreadsheets in expanded memory, as well as allocated 1MB each to disk and RAM caching.

Zenith, aware of its competitive disadvantages, has been aggressive in pricing the CGA version. You can find the 20MB version for $2,500 to $3,000 street price, with a Zenith rebate. ■

Zenith SuperSport 286
Zenith Data Systems, 1000 Milwaukee Ave., Glenview, IL 60025; (800) 553-0331.
List Price: With 2MB RAM, 40MB hard disk, 1.44MB 3.5-inch floppy disk drive, CGA display, DOS 3.3 Plus, $5,398; with VGA display, $6,998.

CIRCLE 411 ON READER SERVICE CARD

ZENITH SUPERSPORT 286

Last review: July 1989, page 139
Reason selected: Market leader
Positive findings: Rugged construction, solid keyboard feel, large screen.
Negative findings: Heavy and bulky; old-fashioned CGA-only display (until recently); lacks dedicated cursor keys.

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5267	½" × 1¾"	80	25
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5161	1" × 4"	20	100
5162	1⅓" × 4"	14	100
5163	2" × 4"	10	100
5164	3⅓" × 4"	6	100
5165	8½" × 11"	1	100
Laser Diskette Labels			
5196 for 3½" diskettes	2¾" × 2¾"	9	70
5197 for 5¼" diskettes	1½" × 4"	12	70
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5295	3⅓"	6	25

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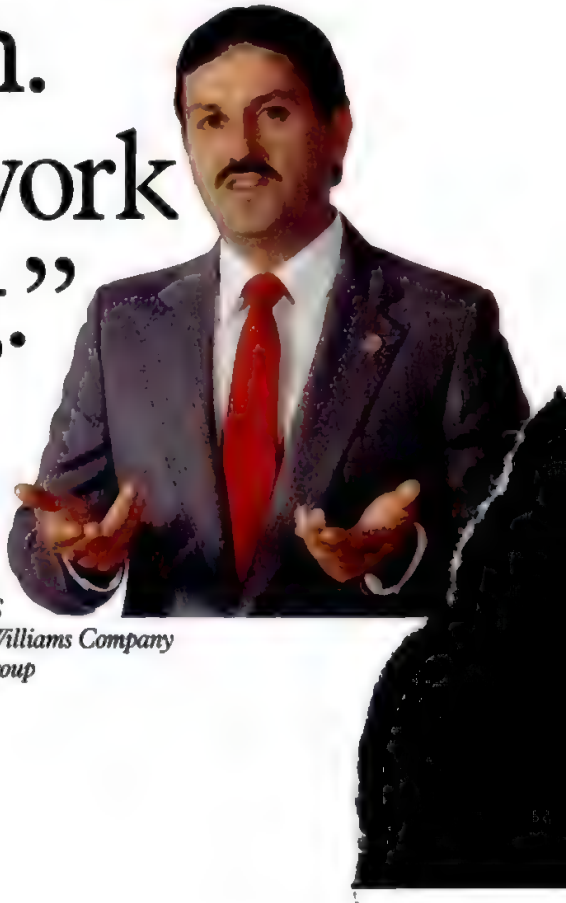

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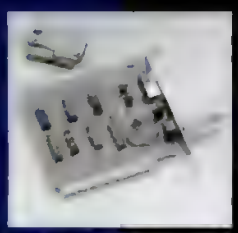

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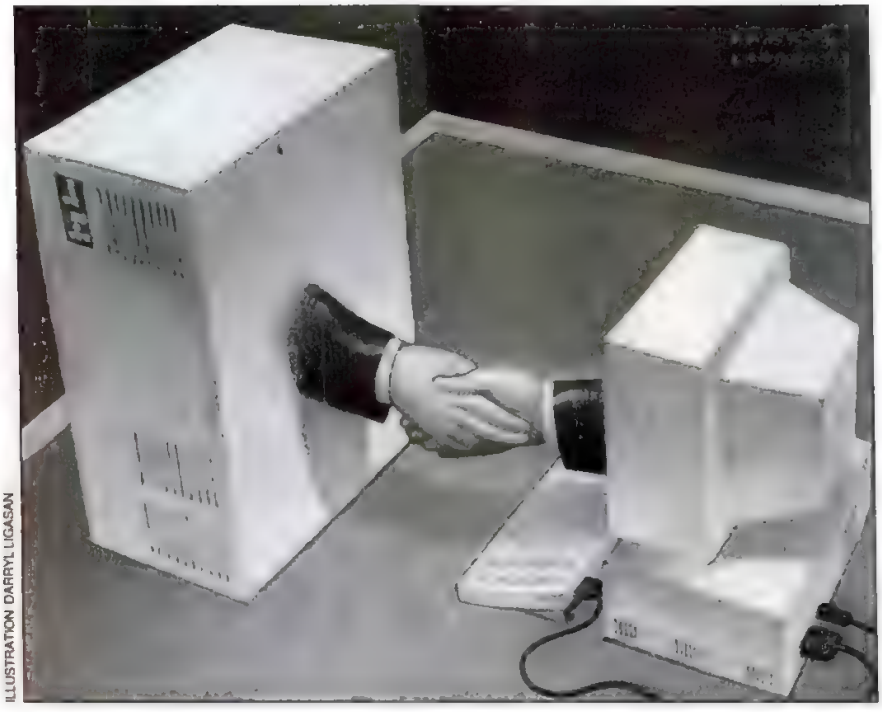


ILLUSTRATION DARRYL LIGASAN

PC MEETS VAX

by Paul Ferrill

As minicomputers fade away, Digital Equipment Corp. takes the plunge into PC integration. Enter DEC's new LAN server.

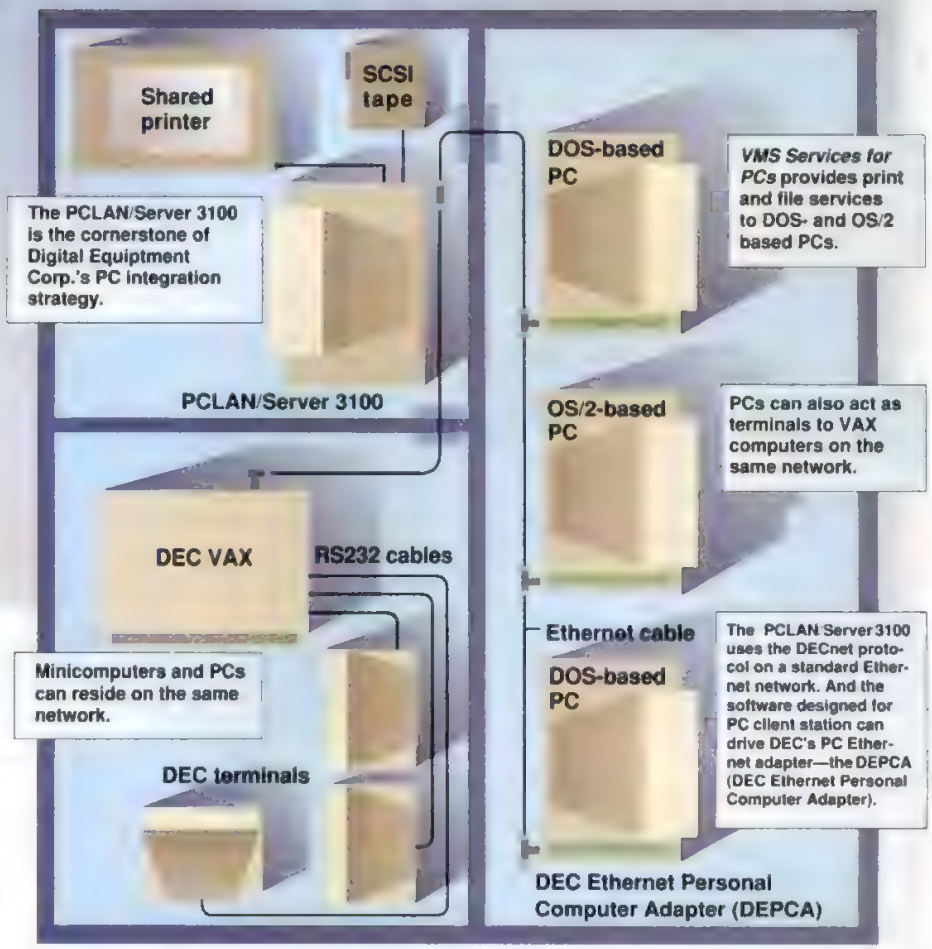
For years, Digital Equipment Corp., better known as DEC, has played Avis to IBM's Hertz. The two companies' 1988 revenues tell the story: DEC scored $12.2 billion while IBM pulled in $55 billion, according to *Datamation*. Playing second fiddle to Big Blue has forced DEC to adopt a long-term strategy of looking for ways to compute and integrate with more horsepower at lower cost, and it's the buyer who benefits. Lately, DEC has adjusted its focus to integrating PCs and minicomputer systems. In June of 1989, the company announced the PCLAN/Server 3100, an integrated package targeted at the installed base of large DEC systems; it solves $12,500 worth of networking problems.

Digital recognizes that integrated multivendor systems are the rule today. In mid-1989, DEC began selling a line of IBM-compatible PCs that the company remarkets from Tandy. And now DEC's system architecture has room for many non-DEC products. DEC technical support people have been to Novell's schools and are more than willing to help you put Novell's *NetWare* LAN operating system on a VAX. The folks from DEC are well versed in the available methods for integrating PCs and VAX computers and for linking combined networks to IBM mainframes.

The cornerstone of DEC's PC integration scheme is a new piece of hardware designed to act as a file and print server for a network of PCs. The PCLAN/Server 3100 uses a "VAX on a chip" processor and the DEC VMS operating system. While designed as a server, this computer is completely compatible with all existing DEC minicom-

A NETWORK FOR MINIS AND MICROS

The PCLAN/Server 3100 is the cornerstone of Digital Equipment Corp.'s PC integration scheme. It allows PCs and minicomputers to be hooked up on the same network. The PCLAN/Server runs on *VMS Services for PCs*, a version of DEC's operating system VMS (Virtual Memory System) that provides print and file services for DOS- and OS/2-based PCs over Ethernet cable, using DECnet. The Personal Computing Systems Architecture (PCSA), on which the 3100 system is based, gives client workstations the ability to contact multiple servers over Ethernet. Compatible with DEC's VAX minicomputer line, the PCLAN/Server also lets PCs act as terminals to VAX computers on the same cable.



puter applications. You can use it as a server for a network of PCs and as a shared processor for terminals or as a high-powered VMS workstation. But the main marketing thrust of the product is toward acting as a server for a network of PCs running MS-DOS or OS/2.

DEC has a strong commitment to the International Standards Organization's Open Systems Interface architecture. The introduction of the PCLAN/Server 3100 clearly illustrates the new "open" position taken by this formerly conservative company.

OUT OF THE MILL

DEC got its start almost 33 years ago in an old textile mill in Maynard, Massachusetts. At the time, computers were limited to performing accounting and payroll functions, but founder and CEO Kenneth Olsen had something else in mind. He envisioned computer systems that would be affordable to engineers and scientists and would not require a sterilized environment to operate.

From DEC's first minicomputer, the PDP-1, to the present-day VAX series of minis, DEC has come a long way. The PDP-1 was announced in 1959 and was the first of its kind. It boasted an unheard-of innovation—a CRT integrated into the console. Although the system was housed in a cabinet about the size of a refrigerator, it only required normal office power and air conditioning.

The VAX 11/780 computer, introduced in October 1977, was DEC's attempt to compete with the king of the hill—IBM. This entry was intended as a more powerful computer that would give current DEC users a path to migrate upwards without having to discard their existing investment in software and peripherals. The computer offered a compatibility mode in which software written for the PDP-11 series of minicomputers would run on the new model without modification. It also contained a compatible bus structure so that existing peripherals could be used.

In May 1980, DEC made another significant announcement intended to chip away at IBM's dominance. Along with Xerox and Intel, DEC introduced its Ethernet plans to the world. Now almost as famous as the peanut butter and jelly sandwich, Ethernet has established a following by providing a way to connect computers in offices and across campuses with economy and speed.

THE VMS OPERATING SYSTEM

When DEC released the first VAX computer, it also came out with its Virtual Memory System (VMS) operating system. This was written to take full advantage of the 32-bit architecture of the VAX hardware. The VAX 11/780 with VMS was a true multitasking/multiuser hardware-and-software system.

At the time of its introduction, VMS was unique in its ability to run programs that take up more memory than is available in the computer. The computer handles this deficit by moving chunks of memory called *pages* between the main memory and the disk. Memory paging is a valuable feature, but by now it's well known that paging can make for slow performance if there are many users and insufficient memory in the system to accommodate them.

USING YOUR DEC VAX AS A SERVER: Let Me Count the Ways

by Frank J. Derfler, Jr.

Digital Equipment Corp.'s VAX computers are ubiquitous. For every office that has them, there are a dozen businesspeople who would like to use all that paid-for hardware to service networks of PCs. DEC's Personal Computing Systems Architecture (PCSA) software, which runs in the DEC PCLAN/Server 3100 as well as on other VAX computers, offers one solution. But since Novell's *NetWare* has such a large market share in existing PC-based networks, many folks would like to have an alternative using DEC hardware but without sacrificing *NetWare* compatibility.

Not surprisingly, Novell has a product it calls *NetWare for VMS* that lets a VAX computer provide *NetWare* services, but quite surprisingly, the product has some competition. A company by the name of Datability Software Systems markets *RAF Remote Access Facility*—software that promises better *NetWare*/DEC compatibility than either DEC or Novell.

Novell's *NetWare for VMS* allows PC workstations running the *NetWare* shell to link to a VAX acting as the central file and print server. PC file servers running *NetWare* and VAXes running *NetWare for VMS* can simultaneously service large networks of PCs. But what is missing in this product is the ability to use the DECnet protocol or Local Area Terminal (LAT) protocol for emulating DEC terminals. Thus the VAX running under *NetWare for VMS* literally loses its identity as a VAX to the PC client stations.

RAF allows PC client stations to access VAX and Novell files over the same Ethernet card. The good news is that it does use DECnet as its underlying protocol and can do the LAT emulation as well. The PC software takes up 120K of regular memory, or 90K if the system has expanded or extended memory installed.

The *RAF* software runs on the VAX computer as well as on the PC client stations. Through *RAF*'s LAT protocols, the PC becomes a terminal off the VAX computer. However, *RAF* includes full integration with the *NetWare* shell so that the VAX appears as additional disk drives. You use standard DOS commands in order to transfer files between the client and either the *NetWare* or DEC computers.

Other snappy features of RAF include the ability to designate any printer attached to a workstation as available to the network. A potential drawback to this product is that Datability must integrate its program with DEC's software and is vulnerable to any changes DEC may introduce.

At your disposal are at least three paths to DEC/PC integration. You can use DEC's approach with the PC LAN/Server 3100 or other VAX hardware, you can follow Novell and see the VAX as purely a *NetWare* server running *NetWare for VMS*, or you can give every workstation simultaneous access to a *NetWare* server and a VAX through *RAF*. And you thought the decision process was over with your DEC purchase! ■

NetWare for VMS, Novell Inc., 122 East 1700 South, Provo, UT 84601; (800) 379-5900.
List Price: $5,500 to $26,500. Novell bundles *NetWare for VMS* in five levels. The selection depends on the type of VAX hardware and the version of the VMS operating system you use. The $5,500 version of the software runs on MicroVAX and VAXstation 3100 computers.

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RAF Remote Access Facility, Datability Software Systems, 322 Eighth Ave., New York, NY 10001; (212) 807-7800.
List Price: Start-up pack, including four units of licenses and documentation, one Host Software media kit, and four Interlan 5210-16 Ethernet cards, $3,100.

CIRCLE 609 ON READER SERVICE CARD

Frank J. Derfler, Jr., is workgroup systems editor of PC Magazine.

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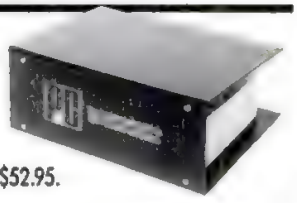

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FALSE START

DEC's first attempt at a PC was something called the Programmable Data Terminal, or PDT for short. PC folklore has it that Dan Bricklin, author of the *VisiCalc* program, tried to purchase one of these early machines. When his attempts to buy a PDT failed, he settled for an Apple II borrowed from fellow student Dan Fylstra. *VisiCalc* went on to vitalize and legitimize the Apple while the PDT sank from sight.

The second entry in the PC fray—the DEC VT180, nicknamed Robin—was not really an entry at all, but an add-in to DEC's VT100 terminal. It consisted of a CPU board based on the Z-80 processor and two external 5.25-inch disk drives. This configuration turned a DEC VT100 terminal into a personal computer running the CP/M operating system. The VT180 hit the market in the middle of 1981—shortly after IBM introduced its first PC.

In May of 1982, DEC announced an entire line of personal computers. Armed with dual processors and capable of running multiple operating systems, the DEC Rainbow 100 was designed to be the IBM PC's real competition. But the lack of complete compatibility with software produced for the IBM PC prevented the Rainbow 100 from threatening IBM's market dominance.

DEC'S PCLAN/SERVER 3100: SUMMARY OF FEATURES

GENERAL INFORMATION	PCLAN/Server 3100	NetWare 386, Version 3.0	3+Open LAN Manager, Version 1.1	NetWare 286, Version 2.15
List price	$12,500 (includes server)	$7,995	$3,495	$4,995
Peer-to-peer resource sharing	Optional*	■	■	❑
NETWORK OPERATIONS				
Server				
Special hard disk format	■	■	❑	■
Fault tolerance	■	■	❑†	❑
Maximum number of network cards bridged	1	16	5	4
Maximum number of simultaneous log-ons	64,000	250	1,000	100
Server software				
Number of disks	7	10	12	35
Additional operating system required	VMS	None	OS/2 (included)	None
Supports disk caching	■	■	■	■
Workstation software				
RAM available for applications	414K to 520K	556K	520K to 589K	540K
RAM available with NetBIOS	414K to 520K	516K	520K to 565K	516K
Compatible with OS/2 workstation	❑	■	■	■
File system limits				
Concurrent open files per server	Unlimited	100,000	8,000	1,000
Volumes per server	Unlimited	32	26	32
Physical drives per volume	32	32	1	1
Physical drives per server	14	1,024	12	32
Allows files to span multiple drives	■	■	❑	❑
Maximum file size	4GB	4GB	2GB	255MB
Maximum volume size	4GB	32TB	4GB	255MB
Maximum physical RAM	32MB	4GB	16MB	12MB
Maximum total disk storage	4GB	32TB	7.5GB	32GB

■—Yes ❑—No MB = megabytes, GB = gigabytes, TB = terrabytes

* This feature is available with additional DEC software.

† This feature is available via a third-party product.

When the Rainbow 100 failed to reach anticipated sales levels, DEC looked to its installed base of PDP and VAX machines as a market for personal computers. This reevaluation led to the introduction of the VAXmate. Announced in September of 1986, it was intended to be the perfect answer for customers that had big DEC machines and were looking for a PC solution. The VAXmate was small, powerful, and practically portable, and it sold well into a few markets, but it still wasn't a PC.

DEC's recent alliance with Tandy gives it immediate legitimacy in the PC market. Their agreement allows DEC to put its label on several popular Tandy 80286 and 80386 PCs with proven compatibility.

A HISTORY OF NETWORKING

The backbone of all DEC networks is DECnet, a LAN product introduced concurrently with the VAX 11/780. DECnet is a network architecture, primarily implemented in software, that permits multiple computers to link using any of several kinds of connections and to share resources such as large disks and printers.

The original DECnet was designed for parallel interfaces and was intended to connect computers located within 20 or 30 feet of each other. Serial interfaces were available for longer distances, but were far slower than parallel connections.

	PCLAN/Server 3100	NetWare 386, Version 3.0	3+Open LAN Manager, Version 1.1	NetWare 286, Version 2.15
ADMINISTRATION				
Network administration				
Keeps historical error/status log	■	■	■	■
Keeps accounting information by user or resource	❑	■	■	■
Adds or deletes network resources while network is running	■	■	■	❑
Reports number of bad packets	■	■	■	■
Reports network errors	■	■	■	■
Monitors open files	❑	■	■	■
Shows names of users logged on	❑	■	■	■
Shows percentage of server being used	■	■	❑	■
Security				
Access to network resources can be determined by membership in a group	■	■	■	■
Passwords can be associated with network resource names	■	■	■	■
Software sends encrypted passwords over the network	Optional*	■	■	■
Access can be granted via level	■	■	■	■
Access can be controlled by time and date	❑	■	❑	■
USER FEATURES				
E-mail service				
Store-and-forward e-mail system	■	❑	■	❑
Can attach binary files to messages	❑	❑	■	❑
Allows rude messaging	■	❑	■	■
Printing				
Software handles print spooling	■	■	■	■
User can modify print queue	■	■	■	■
Maximum number of printers supported	16	16	32	5
Workstation printers supported	❑	■	❑*	❑
Software supports downloading fonts	■	■	■	■

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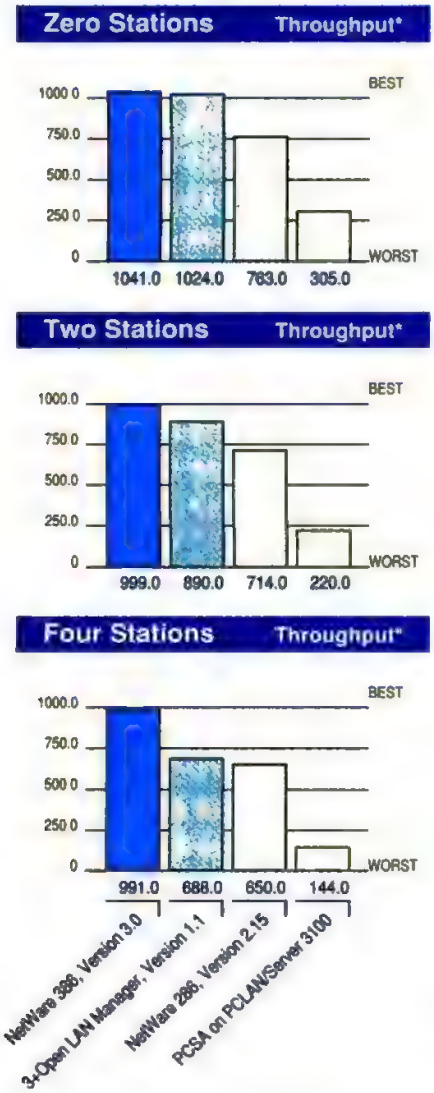
BENCHMARK TESTS: DEC'S PCLAN/SERVER 3100

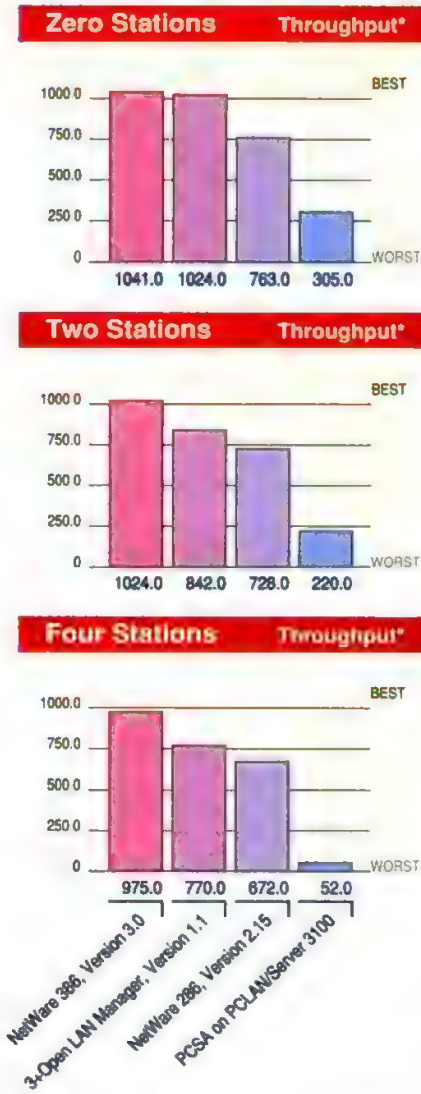
Using shared files, DEC's PC Systems Architecture (PCSA) is markedly slow, but a read-only mode provides a constant throughput of over 300 kilobits per second under heavy loading conditions. Similarly priced networking systems such as *NetWare 286* and *3+Open LAN Manager* provide better performance, but a promised new release should triple the throughput of DEC's software, putting it within the competitive ballpark.

NETWORK THROUGHPUT UNDER LOAD



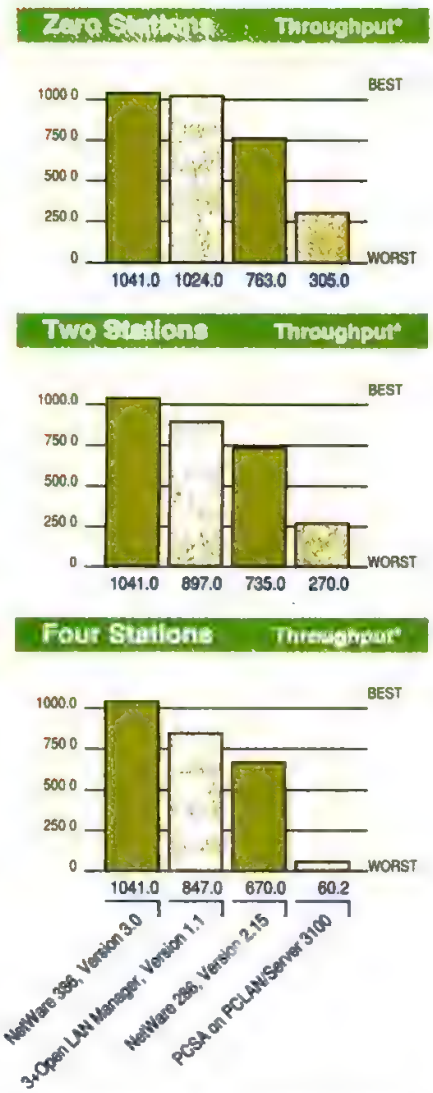
The **Network Throughput Under Load** test loads network cards, media, and access protocols but places a small load on the server. While the timed station transfers files, load stations read and write 1-byte data files, creating a high volume of data packets and increased activity on the network.

HARD DISK ACCESS LOAD



The **Hard Disk Access Load** test heavily loads the hard disk and disk-caching system. Each load station randomly accesses its own 100K data file using 1K records while the timed station transfers files. This procedure tests how well the software handles the drive and the speed of the disk subsystem.

DATABASE LOAD



In the **Database Load** test, all stations share a 4MB data file and its index file during reading, locking, and writing tasks while the timed station transfers files. This test reflects the record-locking support of the system and the way it handles a number of random, simultaneous accesses to a common file.

*Kilobits per second.

CONTINUES

PCLAN/SERVER 3100 BENCHMARK TESTS: COMPOSITE VIEWS

The PC LAN Labs benchmark tests were written in C and are independent of commercial software. Each load station operates at a rate many times that of a PC in a typical heavy-use environment (such as a data-entry operation). We have designed these tests so that a single station represents five to ten times the load of a user performing an interactive task (such as updating records) on a typical network.

The **Network Throughput Under Load**, **Hard Disk Access Load**, and **Database Load** benchmark tests each report the throughput recorded during the performance of a standardized task on the network. To obtain the figures shown here, we run a test program performing a sequential create, a sequential read, a sequential write, a random read, and a random write of a large file. The record sizes used in these activities systematically rotate among 16K, 4K, and 512 bytes. Usually a 1MB file is used, but this size may be adjusted for unusually fast or slow networks.

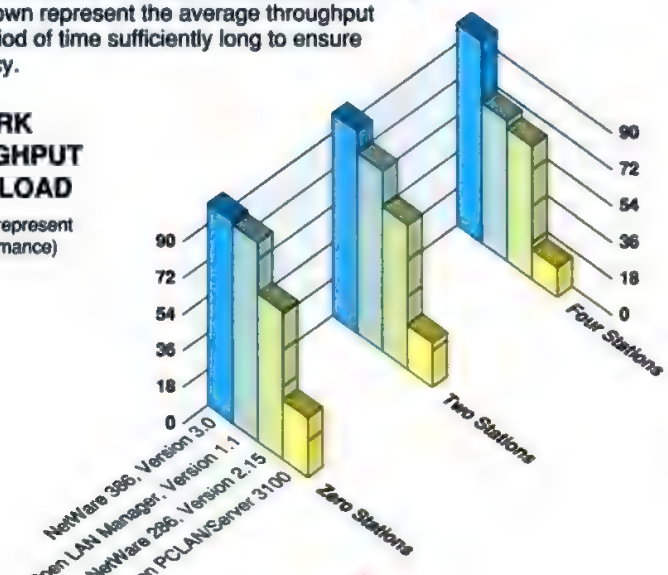
While the general test program is run, we load the network with specific programs for each of our three benchmark tests. The results shown represent the average throughput over a period of time sufficiently long to ensure consistency.

The DEC PCLAN/Server 3100 was configured with the help of on-site DEC technical staff and operated over thin Ethernet cable. All workstations used DEC's DEPCA network adapter. *NetWare* was run on an IBM PS/2 Model 80 with 7MB RAM and Core high-speed hard disk drives. The server used Novell's 32-bit Ethernet adapter, and workstations used Gateway's G/Ethernet adapters. *3+Open LAN Manager* ran on a 3Com 3S/500 server with 7MB RAM. The workstations, 12-MHz Dell System 200s, used 3Com's 3C503 adapters.

As our test results demonstrate, DEC's PCSA file-server software slows considerably under the load of multiple PCs accessing shared files. Looking at separate steps within these tests, we found it particularly inefficient in moving the small data blocks that many database applications use. Throughput increases significantly when more-efficient big blocks are used; these blocks are typical of file transfers and applications such as word processing.

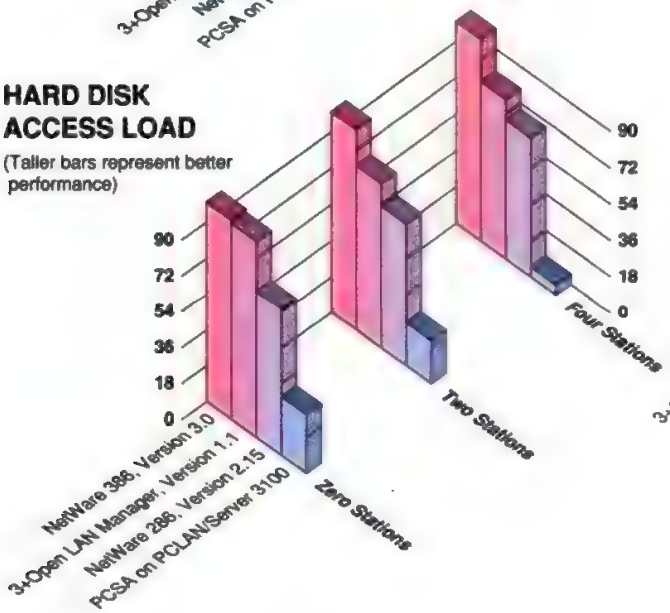
NETWORK THROUGHPUT UNDER LOAD

(Taller bars represent better performance)



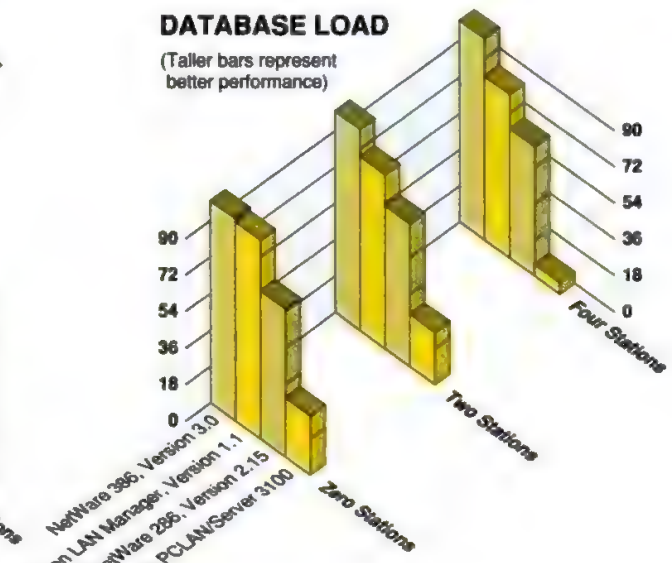
HARD DISK ACCESS LOAD

(Taller bars represent better performance)



DATABASE LOAD

(Taller bars represent better performance)



Relative Throughput (*NetWare 386*, Version 3.0 = 100)

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*Jerry Pournelle holds a doctorate in psychology and is a writer who also earns a comfortable living writing about computers present and future

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CONNECTIVITY

DEC'S PCLAN/SERVER 3100

With DEC's announcement of its Ethernet plans in 1980, DECnet took on new significance. The DECnet protocol layers fit nicely over the Ethernet cable and signaling scheme. The combination allows computers to interact over coaxial cable at distances longer than 1,000 feet without repeaters.

Today, DECnet over Ethernet cabling is DEC's preferred networking solution. DEC customers represent a huge base of Ethernet connections used to link terminals, minicomputers, and PCs together in networks that are becoming increasingly integrated. The cornerstone of this integration is the PCLAN/Server 3100.

A TOTAL SOLUTION

The DEC PCLAN/Server 3100 is about the size of an IBM PC AT, but it has 3.8 times the computing power of the original VAX 11/780. The base model comes with 8MB RAM and a 104MB hard disk. The Ethernet adapter is built into the system box, and the $12,500 package includes a DEC VT320 terminal that serves as the system console.

FACT FILE

PCLAN/Server 3100
Digital Equipment Corp., Maynard, MA 01754-2571; (800) DIGITAL, (508) 493-5111.
List Price: PCLAN Server 3100 with 8MB RA 104MB hard disk, 95MB tape backup, Etherne controller, four serial ports, VT320 terminal console, VMS operating system (Version 5.1 *DECnet-VAX Network Software, VAX VMS Services for MS-DOS, PCMail, SEDT* editor menu-driven installation shell and system administration menus, broadcast utility, $1 DEPCA-KA PC Network Integration Packa each workstation), including Ethernet cont mouse, LK250 keyboard with IBM AT-com cable, *DECnet*-PCSA client software licen $845.

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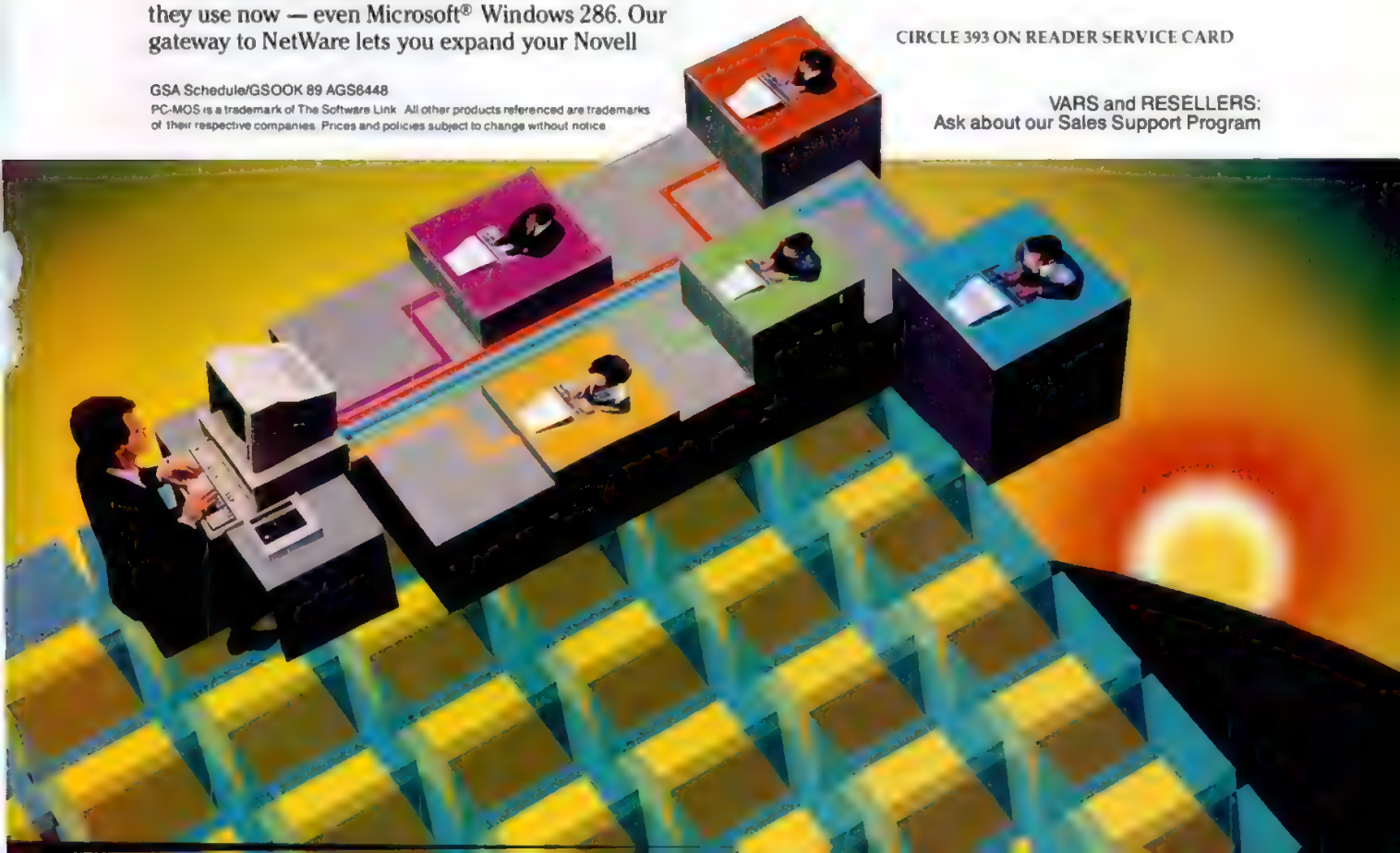

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DEC'S PCLAN/SERVER 3100

Don't look inside the 3100 for the expansion slots found in PC-type machines. If you want to add memory (up to 32MB), you must attach daughterboards to the main system board.

The system is relatively small, expandable, and quiet. It needs no special care and can even be installed in a closet or under a desk. Several layers of password protection keep the data on the server safe from local access.

The PCLAN/Server 3100 uses a standard Ethernet network, and the software designed for PC client stations can drive DEC's PC Ethernet adapter, called the DEPCA (DEC Ethernet Personal Computer Adapter). The software is easy to configure and uses the widely accepted MS-Net NETUSE and similar command syntax.

The DEC PCLAN/Server 3100 is relatively small, expandable, and quiet. It needs no special care, can be installed under a desk, and has 3.8 times the computing power of the original VAX 11/780.

For those who want to turn a PC into a VT series terminal clone, DEC offers a DEPCA Network Integration Kit that includes a special keyboard with VT-style special function keys, DEC mouse, and software license for $845.

The PCLAN/Server 3100 doesn't have a floppy disk drive, but it does have an internal SCSI adapter. DEC delivers the computer loaded with the VMS operating system and the file server software, so you don't need any input device to get started. Just flip the power switch and start adding users.

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If you want to use other VMS software, you can connect any of DEC's external SCSI devices. The system tested at PC LAN Labs included a DEC TK50 tape drive. This device uses a tape cartridge with a 95MB capacity and is useful for loading new software, updating software, and archiving data. In our system the tape drive was external, but DEC states that it will be internal in later deliveries. Other devices can be added using the SCSI interface, including up to three 323MB hard disks.

The Personal Computing Systems Architecture, on which the 3100 is based, lets client workstations contact multiple servers through Ethernet.

CAPABILITIES THAT COUNT

Network services provided by the PCLAN/Server 3100 include two types of file access, the use of shared printers, and links to other DEC and non-DEC machines. Additional hardware and software can provide SNA links to IBM mainframes as well as 3270 terminal emulation.

The standard PCLAN/Server 3100 box comes with four serial ports. One of these is taken up by the system console, leaving three additional ports to be configured for other devices such as modems or printers. Installation is particularly simple if the printer happens to be made by DEC; the system administration menu provides options for nearly all DEC printers. If the printer isn't made by DEC—for instance, if it's the ubiquitous Hewlett-Packard LaserJet—you must enter additional commands to configure the DEC software for a "nonstandard" printer. This procedure, which requires knowledge of the VMS command language, is documented in the manuals provided.

The Personal Computing Systems Architecture (PCSA), on which the 3100 system is based, gives client workstations the ability to contact multiple servers through Ethernet. The PCLAN/Server 3100 also acts as a gateway to other DEC machines. Any PC attached to the PCLAN/Server can connect to any other VAX machine on the network. This is accomplished using the SETHOST terminal emulator program provided with the PC software. Making connections to an IBM mainframe requires additional hardware and software.

SOFTWARE COMPLETES THE PICTURE

Well-integrated software is the icing on DEC's 3100 cake. The VMS operating system comes standard with the PCLAN/Server 3100; available as an option is the Ultrix operating system—DEC's version of Unix. Because these operating systems are loaded at the factory, they're ready to run right out of the box.

In addition to the all-important PCSA software, the 3100 system utilizes file

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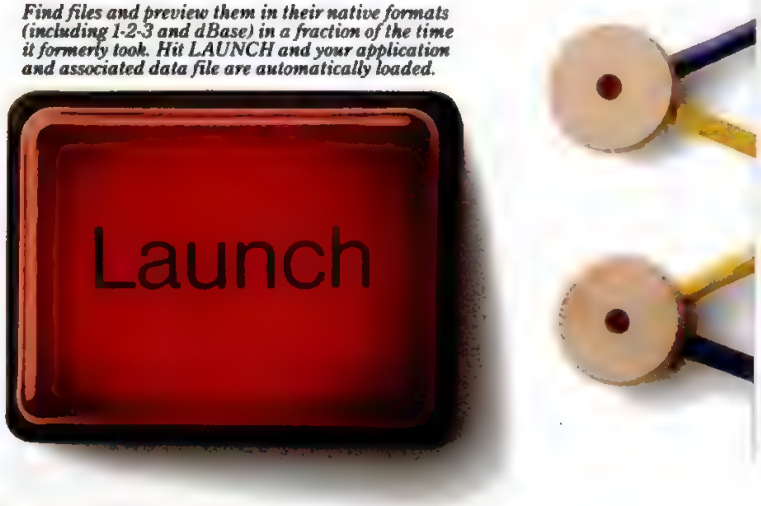

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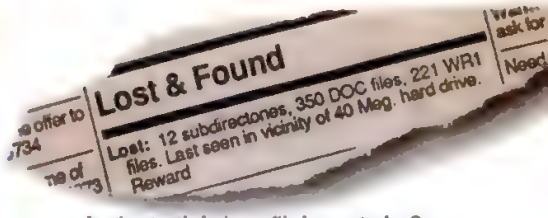

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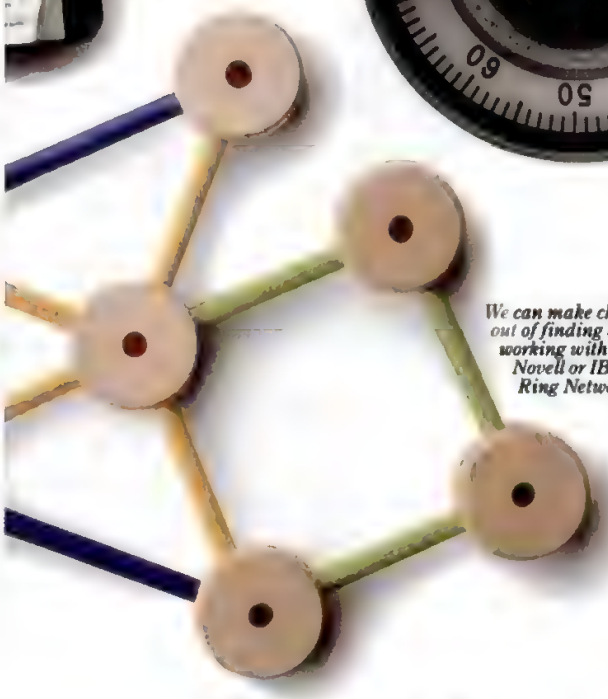

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dows, full mouse support, pull-down menus and context sensitive help make learning and using the product a breeze. And PC Tools Deluxe conforms to IBM's Systems Application Architecture (or SAA) standards so its look and feel is almost identical to all the other applications you'll see in the 90s.

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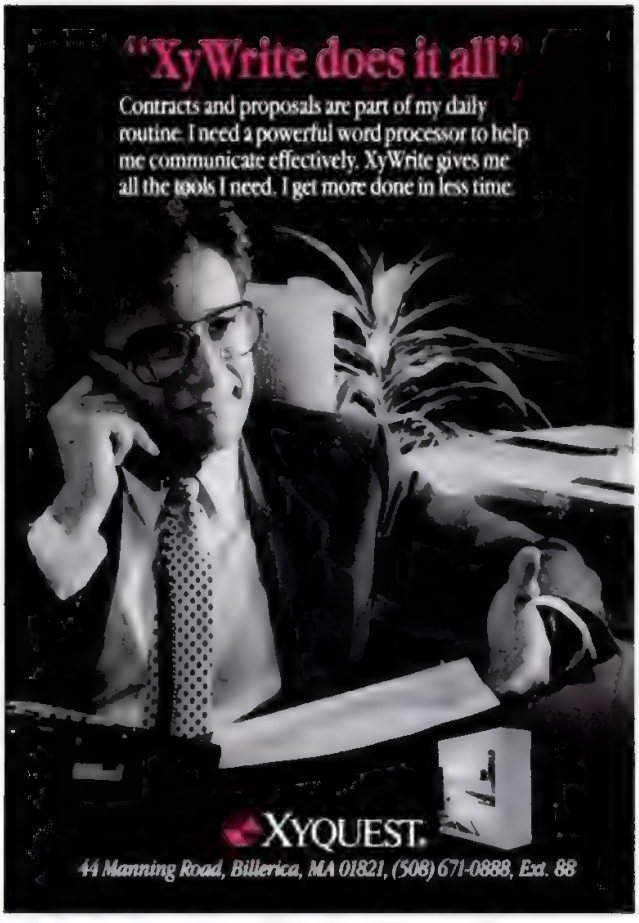

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server software (VMS Services for PCs) and workstation software based on Microsoft's redirector, which is also used by IBM and many other companies. These workstation and server products run on top of DECnet, which in turn runs on top of Ethernet. NetBIOS services are available in the workstation protocol stack.

Since the PCLAN/Server 3100 runs the same operating system as the other larger VAXes, the commands are the same. Print queues are set up just as on a large VAX system and are available to the PC users via the PCSA software.

DEC's documentation set includes over a dozen thickly stuffed three-ring binders. The manuals have illustrations, indexes, and glossaries to spare, and they're easy to read. DEC's world of acronyms is daunting to the uninitiated; these manuals are more valuable to someone with some experience or schooling in DEC's way of doing things.

Well-integrated software is the icing on DEC's 3100 cake. The VMS operating system is standard; Ultrix, DEC's version of Unix, is also available. Both are ready to run right out of the box.

The standard software distribution includes a copy of *Microsoft Windows*, *DECWindows* (the DEC X-Windows product), DOS extensions, the SETHOST terminal emulator, and SEDT, which is similar to the text-editor program found on all VAX systems.

One particularly useful feature is that the PCLAN/Server 3100 lets you remotely boot from the server disk. To accomplish this task, a copy of DOS must be loaded

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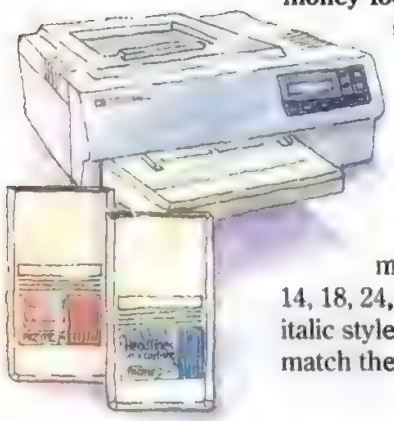

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MAN LOSES HAIR WAITING FOR DOS

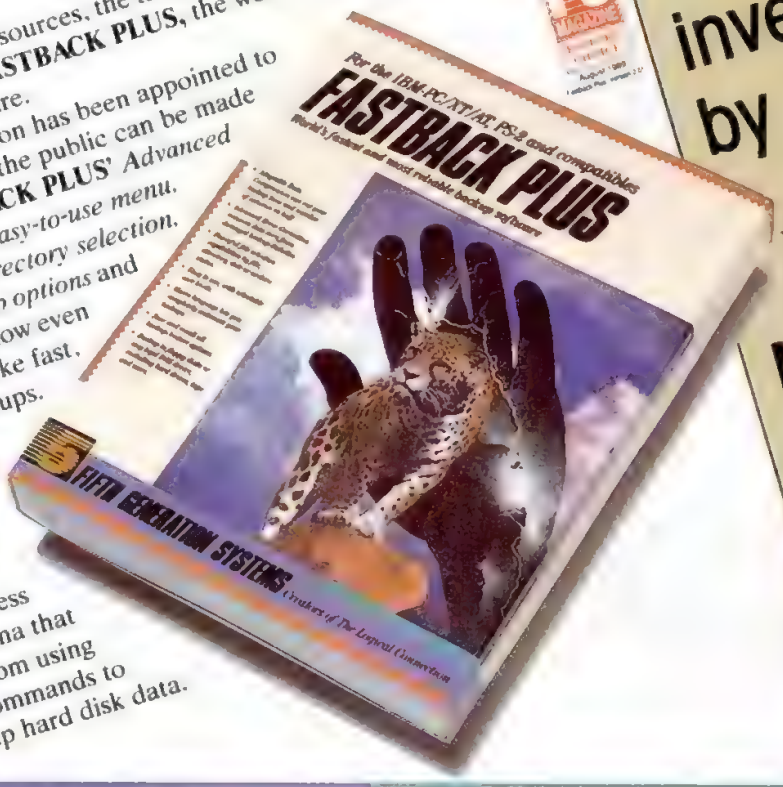
Anytown, USA—The unidentified victim was apparently among the millions of people who still think that DOS Backup and Copy commands are a safe and convenient way to back up their valuable hard disk data.

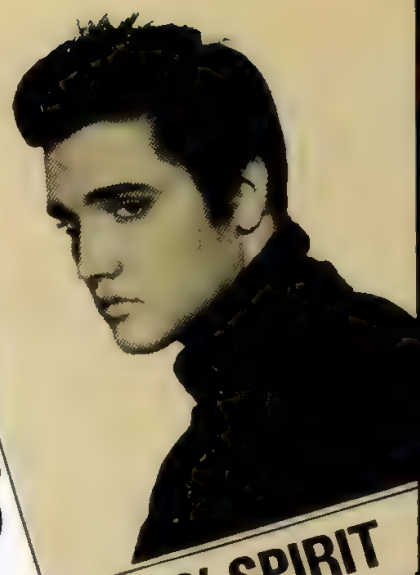
It is not known whether the shocking loss was a result of natural aging while DOS made the backup, or whether the victim pulled his hair out in frustration after discovering that a minor disk error had rendered his entire backup set useless.

According to reliable sources, the tragedy could have been averted if the man had been using **FASTBACK PLUS**, the world's fastest and most reliable backup software.

A special commission has been appointed to study ways in which the public can be made aware that **FASTBACK PLUS**' *Advanced Error Correction, easy-to-use menu, flexible file and directory selection, automated backup options* and other features allow even beginners to make fast, foolproof backups.

Public knowledge of these facts could ease the wide-spread stress and trauma that result from using DOS commands to back up hard disk data.





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onto the server and a "boot disk" created. Once this process is complete, any workstation on the network can be enabled for a remote boot.

VERSIONS AND REVISIONS

As of this review, PC Systems Architecture was in Release 2.2, with Release 3.0 slated to appear in December 1989. The current PCSA turns in a poor showing compared to *NetWare* and other competitors. The beta version of Release 3.0, however, addresses many of our complaints about performance. This early software tested at three times the throughput of the version now being sold.

Our preview of DEC's Christmas present to the world of networking indicated that the new release improves the server's disk caching performance and does a better job of handling multiple simultaneous tasks than its predecessor.

The upcoming version of the software also reduces the load on the workstation's RAM. Release 3.0 should free at least 519K of RAM for application programs; 457K was free in the version that we tested at our PC LAN Labs. The new software can take advantage of both extended and expanded memory in workstations, and users can unload most of the workstation software from RAM.

Our preview of PCSA, Release 3.0, showed that it improves the server's disk caching performance and is better at handling multiple simultaneous tasks than Release 2.2.

SPEEDY ACCESS

There are two different ways that a PC user can access files on the PCLAN/Server 3100. The fastest of the two methods is called high-performance disk services. This mode is specifically designed to give each user a dedicated directory or to provide a place for storing .EXE and .COM files as well as operational software that is loaded into the local memory of the PC. For example, the master copy of a word processor and a database program would reside on the 3100 and would be accessed using this type of disk service. The service does not, however, allow multiple users to write to the data files. The reason that this high-performance mode is fast is because it isn't shared.

The second alternative, which is called file services, is a great deal slower than the high-speed disk service, but it provides users with the read and write that is needed for multiple simultaneous access to the same data files. On our benchmark tests, the throughput of the file-service mode was only half that of the high-performance disk services. Additionally, the high-performance disk services suffered only negligible degradation when multiple stations were used on the server, but the shared service slowed down considerably under multistation service.

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MANAGING THE MOB

To administer the network, the system manager must log in to the VMS operating system either from the system console or from a remote workstation using the SETHOST terminal emulator. When the manager is on-line, the screen presents a menu-driven administration program.

The administrator uses the menu program to add or delete user privileges, to set up file areas for individual users, and to perform general system tasks. A complete set of network statistic and monitoring options is also included. Security is excellent, with password protection and control optional at several levels.

The DEC PCLAN/Server 3100's file server software is a disappointment. The administrator has no choice but to go to a DEC school and become VAX-smart to configure and maintain the network.

One disappointment is the far-from-intuitive file server software. The administrator of this network has no choice but to go to a DEC school and become VAX-smart to configure and maintain the network comfortably.

HELPING HANDS

When it comes to providing service for its products, DEC can stand toe to toe with just about anyone. On-site service is available in most cities in North America and in several locations around the world, and technical and administrative courses are available worldwide.

DEC has devised varying service plans to meet the needs of its diverse clientele. The simplest form of help is DEC's toll-

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EMS Support Software Included	4.0	3.2	4.0	No
Landmark Benchmarks*	23.1	15.4	11.6	15.3
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*Landmark Software version 1.1 benchmarks — a generalized index used to compare one machine to another. The higher the number, the better.
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free 800 number, a service available for a nominal charge for customers with software problems. And software update services allow customers to keep up with the latest releases.

A unique service is the Digital Electronic Store, an 800 telenumber providing callers with access to an electronic catalog of products available from DEC. Current pricing, product information, delivery times, and other pertinent facts can be obtained on-line. The only requirement is that your terminal software be able to emulate a DEC terminal.

ONE PURCHASE

If you have a large or small DEC installation and need a way to integrate PCs and existing hardware, the PCLAN/Server 3100 may be just what you're looking for. Its ability to access massive disks, combined with printer services available on big VAX machines, makes the package a particularly enticing one.

For currently nonnetworked customers who are hunting for a network server, the PCLAN/Server 3100 option provides an exceptional growth path, although options such as *NetWare* and *LAN Manager* prove stiff competition. The PCLAN/Server 3100 is no real competition for *NetWare 286* or *3+Open LAN Manager* in terms of simply providing file services. Both of the other products provide faster file transfers and have well-established customer bases.

If you have a large or small DEC installation and need a way to integrate PCs and existing hardware, the PCLAN/Server 3100 may be just what you're looking for.

Instead, the main niche for the PCLAN/Server 3100 will most certainly be among the established DEC customer base whose members are looking for a way to integrate their PCs.

The PCLAN/Server 3100 provides a sleek solution for the data system manager looking for ways of fully integrating a large DEC mainframe system with the myriad of PC systems that exist in today's workplace. One hardware/software combination from a single vendor, complete with service and installation, can be that plagued manager's dream.

For those whose dollars are already invested in a VAX installation, the PCLAN/Server 3100 is an appealing choice. DEC's most recent marketing push is to help people integrate their PCs, VAXes, and other machines, and this time around, DEC isn't foundering in miscalculated product introductions. Digital Equipment Corp. has an investment in people and products, Tandy's proven PC line, and a solid server to support the entire crowd. ■

A 12-year DEC user, Paul Ferrill is an electrical engineer and a frequent contributor to PC Magazine.

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by
Craig Stinson

Spreadsheets

Exploring the New Features of Lotus 1-2-3, Release 3, Part 1

■ Our new columnist probes the powerful features in the upgrade of an old standby to help you decide whether or not you need them.

Welcome to Spreadsheets, the new edition of Spreadsheet Clinic!

Starting a new column is always exciting and challenging. Significantly revamping an established column is perhaps even more so. After all, if it ain't broke, why fix it? My answer to that comes from Tom Peters's best-seller *Thriving on Chaos*: "If it ain't broke, you just haven't looked hard enough. Fix it anyway."

My aim here is to make the old Spreadsheet Clinic even better—more relevant, more detailed, and more informative. Much of the time I'll continue the popular reader submission format that has been the mainstay of Spreadsheet Clinic all along. But you can also expect to see spreadsheets covered from a variety of angles.

I'll be looking at a greater variety of spreadsheet programs than we have in the past (this is not simply a *Lotus 1-2-3* column), at new add-ins and other accessories, and at new technologies. We'll investigate relational spreadsheets, consider in detail what a third spreadsheet dimension can do for you, and examine Microsoft's *Excel* for OS/2 and Presentation Manager, Borland's exciting new *Quattro Pro*, and much more. The first two installments will probe the new features in *1-2-3*, Release 3.

As always, a lively column depends on lively feedback from readers. So please keep those cards and letters (and disks) coming. This is still the best place to share a brilliant macro or an ingenious workaround. And it's still the best place to get a question resolved. Naturally, we'll still pay you $50 for the items we publish, with a $25 bonus if you send them on a disk.

I've been using, writing about, and teaching others to use spreadsheet programs since Apple II and *VisiCalc* days. I find them not only useful but inherently interesting, and I look forward to sharing my enthusiasm with you here.

1-2-3—THE NEW RELEASE

The latest news in spreadsheets is that *Lotus 1-2-3*, Release 3, is finally here. Though the face is familiar, this is a very new spreadsheet, and the differences between Release 3 and its predecessor are pervasive and dramatic. Nearly every aspect of the program has been strengthened in some way; in every corner, on every menu, there are a number of new tools to learn and use.

Release 3 lets you handle larger spreadsheet tasks than you could before and dispatch simple ones more efficiently. It allows you to generate graphs more quickly and keep them on-screen as you manipulate numbers. It gives you broader control over the printing of worksheets and graphs.

The upgrade also gives you powerful new ways to extract and cross-tabulate information stored in data tables. You'll be able to perform relational operations on two or more tables at once, and (with the proper driver in place) you can reach out and touch information stored in external database management programs.

Getting to know Release 3 as intimately as you now know 2.01 or 1A will take some time and effort. Fortunately, however, you can load your .WK1 or .WKS files directly, without a separate translation step, and learn the new features as you continue working with your older files. Unless they depend on Release 2 add-ins, your existing applications will behave normally in Release 3. Similarly, unless they make menu selections using cursor movements instead of letters, your macros should work without modification. And all your ingrained keystroke habits will continue to serve you well.

To assist you in exploring Release 3, I'll be taking you on a tour of its most important new features in this and the next installment of Spreadsheets. I'll certainly not be able to cover all there is to learn about Release 3; there will still be plenty for you to discover on your own—and in many future installments of this column. But we will be able to get the high spots together.

INSTALLING RELEASE 3

Installation is a three-step process. In the first step, you must "submit" to a brief interrogation about your identity and that of your company. This is required by *1-2-3*'s new "copy-discouragement" scheme shown in Figure 1. Be careful: the names you supply will thereafter flash on-screen whenever you boot the program.

In the second step, you choose an operating system (OS/2, DOS, or both) and target path, and the appropriate files are transferred to your hard disk.

In the third step, after you've identified your display(s), printer(s), and specified any country-dependent preferences, the install program copies the relevant drivers and creates a .DCF file—the functional equivalent of the SET files used by earlier versions. This done, you can quit IN-

STALL and get right to work.

As before, you can create multiple configuration files and run a nondefault configuration by including its name on the DOS command line. Typing LOTUS ODDBALL, for example, will get you the Release 3 Access System with the ODDBALL.DCF configuration in place. Unfortunately, however, the good folk in Cambridge still haven't provided a command-line switch to let you start *1-2-3* and load a particular worksheet at once.

To read more on installing Release 3, see the sidebar "Hardware Requirements to Run Lotus 1-2-3, Release 3."

TWO INSTALLATION TIPS

You can set up two display types in any .DCF file. The /Worksheet Window Display command then lets you switch between them. For example, if you work at a VGA, you can have 80 by 25 color, shown in Figure 2, as your standard display, and use 80 by 34 (see Figure 3) or 80 by 60 color as an alternate.

The INSTALL program doesn't offer a "Choose Alternate Display" prompt, however, so it's easy to miss your opportunity. To install two displays, highlight the item describing your primary display and press the Spacebar. A number 1 should appear to the left of that item. Then highlight your alternate display and press the Spacebar again; a 2 will appear. *Then* press Ins.

Second, you may get bounced out of the installation program if you're using a cache program that caches your A: drive as well as your hard disk. You won't get any explanation for this behavior; instead, you'll get a message that in effect assails your personal integrity. To solve the problem, temporarily remove your cache software, reboot, and try again. Once you've finished the installation, you can put all your good stuff back in. (According to a Lotus spokesperson, this problem may also occur if you're using the DOS 4.01 BUFFERS command with a look ahead parameter.)

Lotus's copy-discouragement scheme, incidentally, is designed to keep you from passing your distribution diskettes (or duplicates) to other users. After you've installed Release 3, you can use normal DOS commands in order to move it to a different directory or drive, and you can back it up the same way you back up any other files. In short, the program is not copy protected; it only looks that way.

EXPLORING THE THIRD DIMENSION

The most important enhancement in Release 3—the one that will probably affect almost everything you do—is its support for three-dimensional worksheets. Figure 4 provides a sample screen. In Release 3, you're no longer limited to a flat array of rows and columns. A .WK3 file starts out as an ordinary two-dimensional grid, but you can insert as many as 255 additional grids, or sheets, into your file. Each sheet is identified by a letter, from A to IV, in the upper-left intersection of the row and column headings. The full address of any cell consists of the sheet letter, followed by a

HARDWARE REQUIREMENTS TO RUN LOTUS 1-2-3, RELEASE 3

by Craig Stinson

Lotus 1-2-3, Release 3, requires an 80286 or 80386 microprocessor and about 3.5MB of hard disk space. You can run it under either DOS (3.0 or later) or OS/2 (1.0 or 1.1). The INSTALL program asks which OS you plan to use; if you want, you can set it up to run under both systems.

Although Release 3's commands are the same under both operating systems, memory management is different. Under DOS, Release 3 supports extended memory to 16MB, plus an additional 8MB of LIM 3.2 or 32MB of LIM 4.0 expanded memory. In other words, if you have the chips and your box can take the heat, you can put a whopping 48MB on-line under DOS (Lotus has actually tested a worksheet that fills this galactic space). Under OS/2, the limits are 16MB of extended memory plus an impressive 128MB of local or remote virtual memory.

As for minima, if you're using DOS, you need at least 1MB. For OS/2, the nominal requirement is 3MB, but Lotus recommends 4MB. DOS users, note that the 1MB requirement means 640K plus at least 384K of *extended* memory. If you're running a 640K system with a 384K expanded memory card, you need to reconfigure the expanded memory as extended. And if you have only 384K of extended memory, you need to remove any cache or RAMdisk software from your system; you must have at least 384K of unencumbered extended memory.

EXTENDED OR EXPANDED?

To get the best possible performance, DOS users should configure as much memory as possible as extended, not expanded. Thanks to Rational Systems' DOS extender technology, the DOS version of Release 3 sees conventional and extended memory as a single linear address space, much the same way as the OS/2 version does. Using expanded memory, on the other hand, entails frequent remapping, which chews up clock cycles.

Obviously, if you run other programs that require expanded memory, you're going to need to split your unconventional memory between extended and expanded. If possible, give Release 3 at least 1MB of extended memory to work with. That way, *1-2-3* can park all of itself in extended memory, leaving almost all your conventional memory available for operations at the secondary DOS command prompt. In other words, with 1MB of extended memory on hand, you can start Release 3 at the beginning of a day and zip out to DOS with /System any time you need to run another application. You will still have enough conventional memory available to run, say, a full-featured word processor without quitting *1-2-3*.

Programs that use 80386 extended memory to emulate expanded memory are OK with Release 3, provided they're compatible with the Virtual Control Program Interface. (For further discussion of VCPI, see Ray Duncan's Power Programming column in the June 27, 1989, issue.) The list of compatibles includes Quarterdeck Office Systems' *QEMM-386* and *DESQview 386*, Compaq's *CEMM*, and Qualitas's *386-to-the-Max*. One prominent incompatible program is *Microsoft Windows/386*. If you depend on an EMS emulator and you're not sure about its status relative to the VCPI, you might want to consult the vendor before you spring for Release 3. ■

colon, followed by the column letter and the row number. Thus, the home cell of the file is no longer A1, but A:A1.

Going from Release 2 to Release 3 is pretty much like moving from ordinary tic-tac-toe to one of those three-level assemblies. The rules of the game are (mostly) the same, but you now have a lot of new possibilities to take into account. Formulas, for example, can now reference cells on other sheets as well as the current worksheet. A range argument for a formula or command can now "tunnel" its way through several adjacent sheets, and so on.

In addition to this multisheet three-dimensionality, Release 3 also allows you to keep more than one file in memory at a time. In fact, you can have as many files active at once as the size of your system (and your taste for complexity) permits. Formulas in one worksheet can reference cells in other worksheets, and you can create such "external" references in POINT mode by using the cursor keys to navigate to the target cells.

What can you *do* with a three-dimensional spreadsheet that you couldn't do in two dimensions? Technically, nothing; but you can do everything you've always done more efficiently.

For example, put each of the functional components of a model—the table of contents, data, modeling logic, reports, and macros—on a separate sheet within a common file. You'll find it easier to locate and modify each section (each can be in the home corner of its sheet, for example), and you'll never have to worry that adding or deleting rows or columns in one area will destroy your work somewhere else.

Or, put analogous data in parallel, identically formatted sheets. This can be data for individual time periods, divisions, departments, or whatever. Any information that you need to see both broken out and consolidated is a perfect candidate for a three-dimensional spreadsheet. In order to consolidate, just add a new sheet, either before or after the component sheets, and write formulas that bore through the component stack.

Having component data lined up back to back in identically laid-out sheets also gives you valuable new ways to look at your data graphically. For example, if you track sales and expenses by quarter for each of a dozen stores in a dozen parallel worksheets, you can chart the COGS (cost of goods sold) by store for any given quarter just by specifying a data range that includes the same cell location in each parallel sheet.

Release 3's GROUP mode makes it easy to set up parallel sheets. With GROUP mode enabled, you can make layout and formatting changes to the current sheet that will be duplicated in every other sheet in the current file. Row and column additions and deletions will affect all

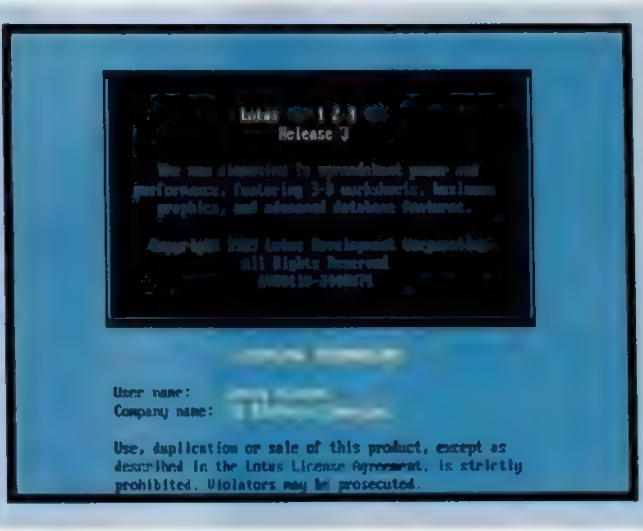

Figure 1: *1-2-3*, Release 3's "copy discouragement" scheme flashes your name and company on the screen each time you launch the program.

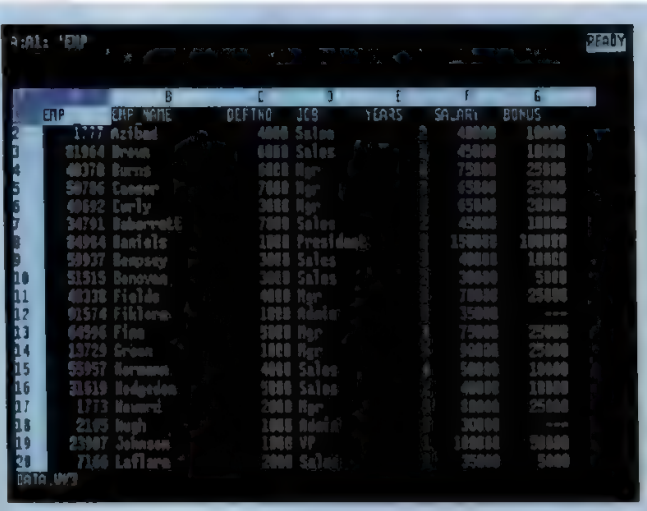

Figure 2: If you work with a VGA, this 80- by 25-line color screen is one of the two display types you can set up in any .DCF file.

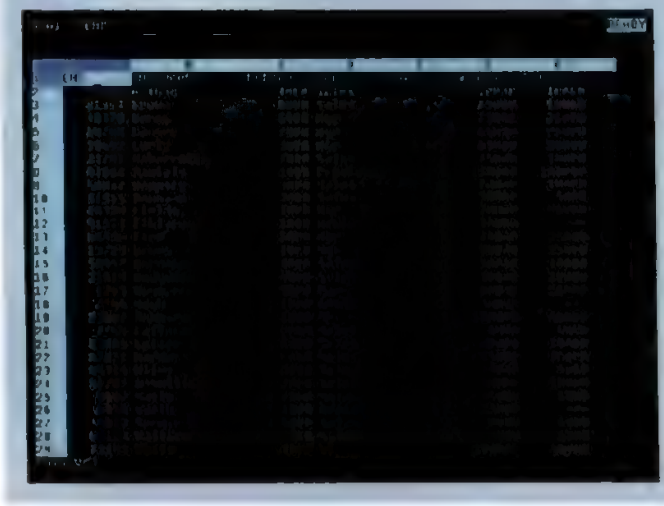

Figure 3: The optional 34-line VGA display lets you see nine additional lines per screen. If you have good eyesight, you can also opt for the 60-line display.

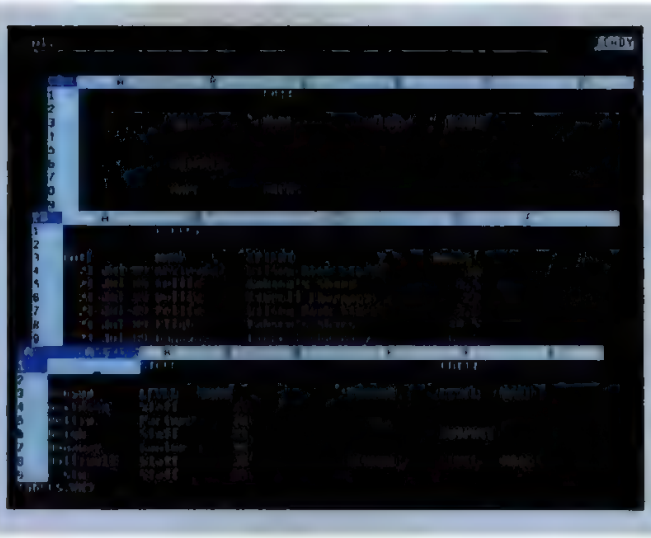

Figure 4: This perspective view lets you see parts of three worksheet pages at once. In this version of *1-2-3*, the windows are fixed in position and size.

sheets in the file, as will any settings made using the commands listed in Figure 5.

Note that when GROUP mode is *not* in effect, /Worksheet Global settings apply to the current sheet only. There is no /Universal command as such: the way to format all sheets simultaneously is to use /Worksheet Global Group Enable.

Also be aware that when you enable GROUP mode, *all* format, column-width, and protection settings—not just changes you make subsequently—will be copied from the current sheet to every other sheet in the file. Therefore, if sheet A is set up the way you want it and sheets B through E are not, be sure you are on A when you enable GROUP mode. Otherwise, in your eagerness to make your sheets consistent, you'll wind up making your only good sheet look just like one of your four bad ones.

Should you happen to make that blunder, however, you can recover instantly by pressing Alt-F4 *only* if you have previously enabled Release 3's Undo capability. The Undo feature lets you reverse your last formatting or editing move. How much memory it uses depends on the complexity of that most-recent move. The default setting for Undo is off, but you can turn it on at any point by choosing /Worksheet Global Default Other Undo Enable. If you find that you seldom hit the memory limits of your system, you might want to change the default Undo setting from off to on. To do that, enable Undo and then invoke the /Worksheet Global Default Update command.

LINKING WORKSHEET FILES

Release 3's "linked file" capability also provides possibilities that may change the way you work. For example, you could put values that are subject to change in a worksheet by themselves, apart from the contexts in which they're applied. This way, if you create many forecasting models based on a common set of economic assumptions, the linked-file approach will obviate the need to go searching through a lot of separate worksheets when you revise your premises. (Even without using linked files, you'll find Release 3's new /Range Search command a godsend. It lets you do a search and replace much the way you do in a word processor.)

File linking can also help you work around memory limitations. The target of an external reference (a formula that gets a value from a cell in another file) does not have to be present in memory. It can be in a disk file, provided you have given *1-2-3* enough information to find it. Thus, by dividing your work into modules contained in separate files, you can create a model that would be too large to fit in memory all at once.

Release 3's ability to keep many files open in memory at once makes it possible to create and maintain a *general-purpose macro library*. No longer do you have to copy the macros you use every day from one worksheet to another. Just create a separate file for your everyday macros and keep that file in memory whenever you work. (You can make the macro library appear in memory automatically at each working session by naming it AUTO123.WK3.) But more about macros later.

INSERTING NEW WORKSHEETS AND FILES

With the new upgrade, inserting a new worksheet into a file is almost exactly like inserting a new row or column. Just use /Worksheet Insert Sheet, then tell *1-2-3* how many new sheets you want and whether you want them inserted ahead of or behind the current sheet. All sheets behind the insertion get relettered, and all references are updated appropriately.

Control Panel Settings

```
/Range Format
/Range Prot
/Range Unprot
/Worksheet Column (all subcommands)
/Worksheet Global Col-Width
/Worksheet Global Format
/Worksheet Global Label
/Worksheet Global Prot
/Worksheet Global Zero
/Worksheet Title (all subcommands)
```

Figure 5: Using these commands while in GROUP mode will execute the change in the current as well as any parallel worksheets.

Inserting a new file involves a slightly different procedure: You start by using /File New. *1-2-3* prompts you for a filename and proposes FILE0001 the first time you do this. You can accept the dummy filename and give it a real name later, when you save.

To bring in a file from disk without overwriting the current file, you use /File Open Before or /File Open After. If the file you name is already in memory, *1-2-3* beeps; you can't open multiple instances of a given file.

To bring in a file from disk that does replace the current file, you use the good old /File Retrieve. The good old caution is in order, too: there's still no warning prompt if you use /File Retrieve to overwrite unsaved work. (Release 3 does warn you if you're about to lose work by quitting or using /Worksheet Erase, however.)

To remove a sheet or file, use /Worksheet Delete Sheet or /Worksheet Delete File (there's no /File Close command). Again be warned: *1-2-3* assumes you know what you're doing and will not keep you from throwing away unsaved work.

NAVIGATING IN THREE DIMENSIONS

Release 3 provides a number of new keystroke combinations to help you navigate from worksheet to worksheet and file to file. These are worth exploring in a bit more detail.

Ctrl-PgUp and Ctrl-PgDn move you forward and backward, respectively, from

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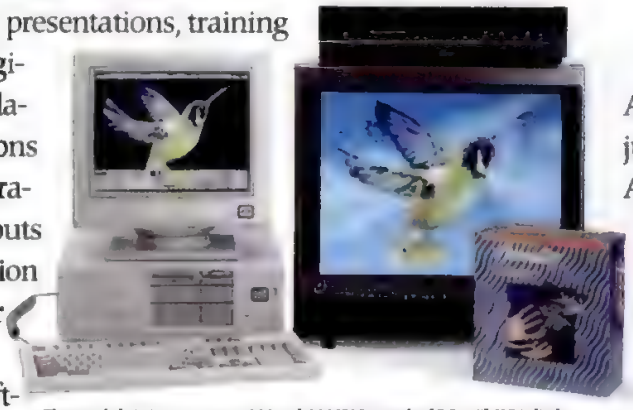

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sheet to sheet. For example, if you're working in a file with three sheets and you're currently on sheet A, pressing Ctrl-PgUp takes you to sheet B. Pressing the same combination again takes you on to sheet C. Ctrl-PgDn moves you back the other way.

If you're in GROUP mode, Ctrl-PgUp and Ctrl-PgDn take you from sheet to sheet on the same cell. That is, if you're on A:E7, Ctrl-PgUp takes you to B:E7. If you're not in GROUP mode, each time you move to the next sheet, you land on the cell you last occupied in that sheet.

If you have two or more files in memory, Ctrl-PgUp and Ctrl-PgDn can also move you between files. If you're on the last sheet in the first file, for example, Ctrl-PgUp delivers you to the first sheet of the second file.

End Ctrl-PgUp and End Ctrl-PgDn move you along the third dimension to the ends and beginnings of data blocks in just the way End works with the various cursor arrows on a two-dimensional sheet. End Ctrl-PgUp, for example, moves you forward (in ascending alphabetical order) through a stack of sheets to the next intersection of a blank and nonblank cell.

To get to the first cell in the current file (cell A:A1), press Ctrl-Home. To get to the last cell in the current file, press End Ctrl-Home. Note that End Ctrl-Home is exactly analogous to End Home in Release 2. The *last cell* it moves you to is the intersection of the last nonblank row, last nonblank column, and last nonblank sheet.

So far, the new keystrokes in Release 3 are rather intuitive extensions of the navigational keys in Release 2. Moving directly from file to file may be a little tougher. The key combinations for moving to the first and last files in memory, respectively, are Ctrl-End Home (easily confused with End Ctrl-Home) and Ctrl-End End. For moving to the next and previous file, the keystrokes are Ctrl-End Ctrl-PgUp and Ctrl-End Ctrl-PgDn, respectively.

If you find these combinations monstrous, you aren't alone. But not to worry: you can use the F5 (GOTO) key to move from file to file just as you use it to move from point to point within a file. When you press F5 followed by F3 (NAMES), Release 3 gives you a list of all named ranges in the current file, followed by the names of all other files in memory. The filenames are enclosed in double angle brackets, for example, «FILE1», «FILE2», and so on. And, as in Release 2, you can press F3 a second time to get a full-screen list instead of a one-liner.

If you typically work with several files at once, you'll probably want to trade in Release 3's clock display, at the lower-left corner of the screen, for a display of the current filename. You can do that by using /Worksheet Global Default Other Filename. To make the change permanent, use the Update command, as well.

PERSPECTIVE VIEW AND ZOOMING

The new /Worksheet Window Perspective command divides the screen into three panels, so you see parts of three sheets at once. These may be three sheets from the same file or, for example, the last two sheets of one file and the first of another. To return to the normal full-screen perspective, you use /Worksheet Window Clear.

Lotus 1-2-3, Release 3, has new options such as keystrokes that allow you to navigate between worksheets and the ability to divide the screen so you can see parts of three sheets at once.

Unfortunately, the new Release of *1-2-3* doesn't let you change the position or size of perspective windows. (Perhaps the upcoming Presentation Manager version, referred to in the press as *1-2-3/G*, will do that). But you can zoom the current window back out to full-screen dimensions while remaining in perspective view by pressing Alt-F6. Press the same combination again to unzoom.

WRITING EXTERNAL REFERENCES

Referencing cells on other sheets within a file is exactly like referencing cells on the same sheet. That is, you can use POINT mode or you can type the cell's name or address. If you type the address, be sure to include the sheet letter followed by a colon; if you omit the sheet letter, *1-2-3* automatically inserts the letter of the current sheet.

Referencing cells in other files in memory is almost as simple. Again, you can use POINT mode or type. If you type, begin the cell reference with the filename enclosed in double angles. For example:

```
@AVG(«WESTERN.WK3»OVERHEAD,«CENTRAL
.WK3»OVERHEAD,«EASTERN.WK3»OVERHEAD)
```

Obviously, unless you really love typing, POINT mode is the way to go. The F3 key will help you find your target. Press F3 once or twice, highlight the filename you want, and press Enter. *1-2-3* puts the filename (complete with path) into the formula and changes the F3 display to list all defined ranges in the selected file. At this point, you can type in a cell address or select a name from the list.

There is one case in which typing an external reference is easier than pointing to it. If the target has a unique name, you can type «?»*NAME*, (where *NAME* is that unique name), and *1-2-3* will fill in the appropriate filename—again, complete with path.

Once the target of an external reference is in memory, the referenced cell is recalculated the same way any other kind of reference is recalculated. That is, with automatic recalc on, it is updated any time the target cell or one of its antecedents is modified. With manual recalc on, it gets recalculated whenever you press F9. (Note that Release 3 performs *minimal* recalculation in automatic mode, updating only those formulas that might be affected by a new entry or edit.)

If the target of an external reference is not in memory, matters are a little different. The referenced cell then is updated when you use the /File Admin Link-Refresh command; use /File Dir or /Worksheet Global Default Dir; change the default file extension with /Worksheet Global Default Ext Save. (provided for those who normally want to save files in .WK1 format); or bring the target file back into memory with /File Open.

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Micrografx Designer 2.0 (Micrografx Inc.)	78	6.3/1.0	84	80	80	77	73	78	78	81	74	74	78	77
Kinetic Art 1.20G (Kinetic Presentations Inc.)	76	11.6/2.0	92	83	80	67	76	64	58	76	87	83	63	78
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Drawing/editing	(100)	Excellent	Good	Excellent	Satisfactory	Very Good
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tile /Copy command. For example, you can replicate a block of cells from one sheet to each of many sheets by specifying a target range that defines the upper-left corner of the block in each target sheet. This, of course, is a straightforward extension of the Release 2 copy command, but there are several points worthy of special mention.

First, the issue of absolute versus relative reference now applies to the worksheet as well as to the row and column. That means you now have eight kinds of reference to play with: absolute, relative, and six species of mixed. In its potential for confusion and creativity, this represents a quantum leap. (As usual, the default is absolutely relative, and you can cycle through all the possibilities by tapping F4 in EDIT mode.)

Second, when copying relative formulas from sheet to sheet or file to file, remember that *1-2-3* will try to update those formulas to suit the new locations. If all you want to replicate are end results, convert formulas to values first with /Range Value. (Fortunately, you no longer have to convert formulas to values when doing a /Range Transpose; Release 3 makes this conversion for you automatically.)

PRINTING FEATURES AND COMMANDS

Earlier this year, Lotus acquired the rights to the technology used in Funk Software's *Allways* add-in for Release 2. *Allways* is a WYSIWYG publishing utility that lets you assign fonts and sizes to individual ranges, intermix graphics with numbers, deploy shading and rules in various densities and thicknesses, and generally dress up your work for a trip to the boardroom or printing press.

Lotus has promised to incorporate these features into *1-2-3*, but they're not there yet. Release 3's changes in the printing department leave it well short of desktop publishing, but they do bring about improvement in the following areas:

- Printing now takes place in the background, so you can continue working.
- You can establish, suspend, resume, and cancel a print queue, as well as control the position of new jobs entered into the queue.
- You can choose most of the printing attributes you're likely to need—including font, pitch, line spacing, orientation, and color—from /Print menu commands. You can also still enter a setup string when you need it.
- You can name and reuse any combination of print settings in much the same way as you name graphs.
- You can print graphs from the /Print menu, and you can control the density, size, scale, and orientation of those graphs.
- You can select from a list of installed printers.
- Additional header and footer codes let you start page numbering at a specified number and link header and footer text to worksheet labels.
- You can now print the worksheet frame (the row and column headings).

The first thing you'll notice on the top-level /Print menu is an item labeled *Encoded*. Since Release 3 lets you print graphics and encourages you to assign fonts, sizes, and other attributes to particular worksheet elements, it also includes options for printing formatted (encoded) files as well as plain text files. So where before there were two choices—Printer and File—at the portal to the print-setting commands, now there are three.

Other new top-level items include Suspend, Resume, and Cancel. These are used for general queue management and error recovery. (Another vital queue-management command, Priority, applies to specific jobs and thus lies deeper in the menu tree.) If your printer runs out of paper or is taken off-line in mid-queue, Release 3 displays an error message at the bottom of your screen. It does not go into ERROR mode (you can keep on working) but it displays the message continuously until you attend to the problem. When you do, you can get things going again by using /Print Resume. If you want to break into the stream yourself (to change ribbons, for example), you can use /Print Suspend. And to abort whatever remains in the queue, there's /Print Cancel.

Fonts, pitch, orientation, line-spacing, and colors are all selected with commands under /Print [E,F,P] Options Advanced. Fonts are numbered on the menu from 1 to 8, according to the general scheme shown in Figure 6. You can examine just how this translates into output from your printer by using /Print Printer Sample Go. The printout generated by this command includes a worksheet example, a graph example, and a list of all current print settings. The text and graphics will show you just what the currently selected printer can do and how its attributes are keyed to Release 3's /Print commands.

Fonts can be applied separately to the header, footer, border, frame, and print range. To output different ranges in different fonts, you have to queue them up as separate print jobs.

Colors are selected by number (from 1 to 8), and they can also be verified with the sample printout. Colors apply to the whole print job, with one exception. If you format negative numbers on the worksheet so that they are displayed in red, those numbers will be printed in red (your printer permitting), while the rest of the job is in black.

You have three pitch options (standard, compressed, and expanded), two line-spacing options (standard and compressed), and two orientation options (the customary portrait and landscape).

```
Sample Font Menu

1  Serif roman
2  Serif italic
3  Serif bold
4  Serif bold italic
5  Sans serif roman
6  Sans serif italic
7  Sans serif bold
8  Sans serif bold italic
```

Figure 6: To change a font in Release 3, you simply select the correct number from a menu.

To name the current constellation of print settings (with or without a specified print range), you use /Print [E,F,P] Options Name Create. To reuse a named set, the command is /Print [E,F,P] Options Name Use. Unfortunately, Release 3 does not provide a straightforward way to create a worksheet-independent library of print settings.

To print a graph, you use /Print [E,F,P] Image Current or /Print [E,F,P] Image Named-Graph. Printing a graph is pretty much like printing a worksheet range. You can put a graph and a worksheet range on the same page (assuming they will fit) by queueing up the two without a form feed between them.

After specifying a graph to print, you can wander farther down the tree to /Print [E,F,P] Options Advanced Image and use the commands there to rotate, scale, or change density. Rotating the graph means switching it from portrait to landscape; you can't flip or tilt it by 45 degrees. Density options are *final* and *draft*. And the scaling options are Length-Fill, Margin-Fill, and

Reshape. Length-Fill and Margin-Fill maintain aspect ratio while stretching the image to fill page length or page width, respectively. Reshape lets you enter your own length and width values.

MACROS IN RELEASE 3

Enhancements in the macro department include the ability to invoke macros by menu (which allows you to surpass the 27-macro limit), the ability to create macro library files, a record feature (of rather limited utility), some new keystroke commands (including a very useful "internal" keystroke), and nine new programming verbs. The /X commands are still supported by the program.

Unfortunately, there is still no debugging facility. You can trace, as always, but you can't set breakpoints or watch particular variables.

Macros no longer must be named \X and invoked via the Alt key. You can now press Alt-F3 and get a horizontal menu of all named ranges. If you press F3 a second time the horizontal menu goes full screen. Just select the macro you want to run, and off it goes. Nor does the macro have to be in the current file; anywhere in memory will do. That means you can create a library of macros for easing the everyday burdens of worksheet building just by keeping that file in memory whenever you work.

Of course, you can still use the standard 27 \X names as well, and these can still be invoked by the appropriate Alt-letter combinations. These can also be stored on any active sheet: as long as the name is unique, *1-2-3* will find it by searching the active files in order, starting with the current file.

The macro recording feature in Release 3 is incorporated into a general-purpose keystroke backup facility that continually keeps track of your keystrokes. A buffer holds your most recent 512 strokes (actually 512 bytes, which isn't always the same thing). You can play back some or all of this buffer, or copy a selection from it to any spot on the worksheet at any time.

To get at the buffer, you press Alt-F2. That summons a four-item menu: Playback, Copy, Erase, and Step. If you're starting a macro-recording session, you begin by erasing the buffer. Then you carry out your macro steps on the worksheet, after which you go back to the buffer, copy your keystrokes to the appropriate worksheet range, name your creation, make any necessary edits, and add the appropriate commentary.

You don't really have to start by erasing the keystroke buffer. If you decide while you're working that the maneuver you just executed would make a handy macro, you can go to the buffer and select just the keystrokes you want to copy for your macro.

Either way, the mechanism is smart enough to wrap the copied keystrokes down through consecutive cells in a column, and it's smart enough to condense keystrokes where possible. (15 up-arrows, for example, will be recorded as {U 15}). Unfortunately, however, when cursor moves are used to define range arguments for functions, the recorder converts them to fixed addresses. Thus, to make a general-purpose macro to do something as simple as sum a column of numbers, you have to edit what the recorder feature produces.

The new keystroke names include the *internal* keystroke {CE}, which stands for "clear entry." This handy token clears away any prompt that may appear on the edit line in response to a command—that is, the current default value. In a way, it's similar to {Esc}. But where {Esc} mimics the Escape key exactly, {CE} wipes off the edit line regardless of how many separate {Esc}s might be needed. (See the sidebar "Advanced Macro Commands.")

One other point should be made about the new macros: the Release 3 add-in facility (formally called the Lotus Development Environment) allows developers to expand the macro language, to add new @ functions, and to create resident applications. So it's a pretty sure bet we'll be seeing some interesting third-party macro products this time around.

I'll keep close tabs on this in upcoming issues, as well as take a much closer look at Release 3 macros than is possible at this point.

ADVANCED MACRO COMMANDS

by Craig Stinson

{**APPENDBELOW**} copies data to the bottom of a target range, expanding the target range to include the incoming data. This command is useful should you need to add records to a database under macro control.

{**APPENDRIGHT**} is analogous to {APPENDBELOW}. You can use it to add fields to a database.

{**SYSTEM**} shells to the operating system and executes a specified command. On termination of the command, control is returned to *Lotus 1-2-3;* the user does not have to type EXIT. You can use @INFO in conjunction with this command to verify the successful completion of the operating system command.

{**FORM**} suspends macro execution and allows the user to enter data into a specified range. Similar to /Range Input but much more powerful, {FORM} gives you precise control over the user's keystrokes. An optional call-table argument lets you tie any number of command sequences to specific user keystrokes. Two other (mutually exclusive) optional arguments let you list user keystrokes that will be allowed or ignored.

{**BREAK**} returns the user from a command to READY mode.

{**FRAMEON**} and {**FRAMEOFF**} control the display of the worksheet frame (the row and column legends).

{**GRAPHON**} presents a full-screen display of the current graph or makes a named graph current (optionally displaying it).

{**GRAPHOFF**} removes a {GRAPHON} display. ■

FILE INTEGRITY IN A MULTIUSER CONTEXT

Release 3 was designed from the beginning to be used in a wide assortment of computing environments, from standalone AT-class machines to full-blown mainframes. LANs and other multiuser contexts figured prominently in Lotus's planning. As the last topic in Part 1 of this column, then, let's briefly consider the new features that have to do specifically with protecting files on networks.

In addition to ordinary password protection under /File Save, which is available in Release 2, Release 3 offers two new means of ensuring file integrity in multiuser environments: the /File Admin Seal commands and a system of reservations. Let's look first at the reservation system.

The reservation system is designed to keep users from overwriting each other's changes to a file when the file is in use at several network nodes. Each file has only one reservation, and only the user who owns the reservation can save the file. Any attempts to save a file without the reservation generates a polite error message.

Who gets the reservation is determined in part by the file's "reservation setting," which may be either automatic or manual. If the setting is automatic (the default), the first user to read the file into memory is automatically awarded the reservation. Users who subsequently load that file will see the legend RO (read-only) at the bottom of their screens. (This indicator also appears when you use /File Retrieve or /File Open to load a file that has been given read-only status by some other means—the network software, for example, or the ATTRIB command.)

If the reservation setting is manual, the file will always be marked RO when loaded into memory, no matter who opens it. In this case, however, you can try to get the reservation by using /File Admin Reservation Get. If available, it's yours.

The reservation may be unavailable for either of two reasons: someone else may own it; or you may no longer have a current version of the file. (Someone else may have written the file to disk subsequent to your reading it). Error messages tell you which is the case; if your version is no longer current, you can just use /File Retrieve to reload it and try again to claim the reservation.

If you own a file's reservation you can relinquish it by means of /File Admin Reservation Release. In response you'll be greeted with the RO symbol.

The second set of safeguards, the /File Admin Seal commands, are designed to protect certain aspects of a file from change. There are two commands: /File Admin Seal Reservation-Setting and /File Admin Seal File. Both accept case-sensitive passwords of up to 15 characters.

The /File Admin Seal Reservation-Setting locks up only the file's reservation setting; no other aspect of the file is affected. To change the reservation setting after this has been done, you must first use /File Admin Seal Disable and reenter the correct password.

The /File Admin Seal File prevents changes (alterations, deletions, or additions) to these file components: the reservation setting; the graph names; the range names; all range notes; all formatting, both global and local; all range-protection settings; all column widths, local and global; all hidden columns or worksheets.

You may still alter the data in a sealed file, and, of course, you may remove the wraps by using /File Admin Seal Disable and reentering the correct password.

Next time we will take a look together at the new graphics features, the new and enhanced database features, and the new worksheet functions in Release 3. Finally, I'll wrap it up with a discussion of whether or not an upgrade is worth the effort.

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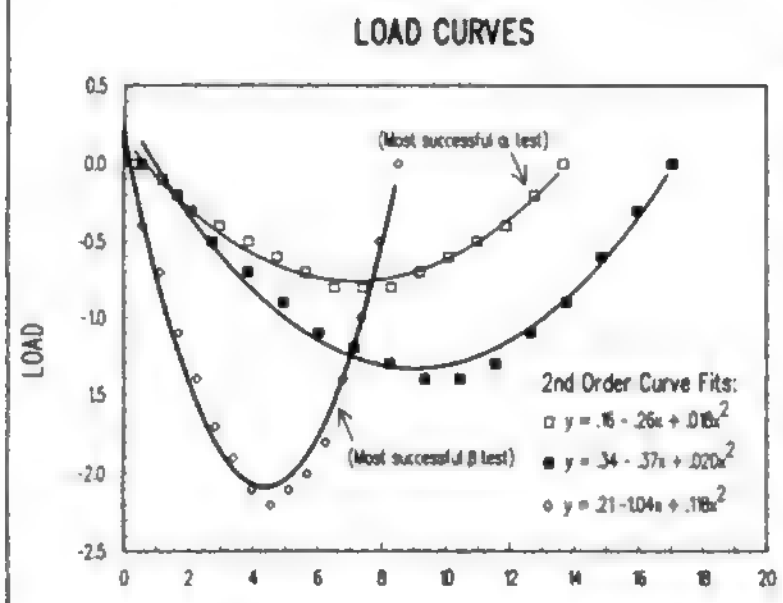

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—Peter Norton
The Hard Disk Companion, p. 338

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by
Terry Lahman

PCREMOTE Lets You Work at the Office Without Leaving Home

Do you ever need to see a file from your hard disk in the office when you're catching up on your work at home? Or do you ever wish that you could run a program that's on your office machine at home?

Now you can. PCREMOTE is a program (actually two programs in one) that lets you access and operate a remotely located computer via modem. Just run PCREMOTE on your office machine before going home and leave the power turned on. Thereafter, you'll be able to call your office computer and run its programs from your home keyboard and monitor.

For the purposes of this article, I'll call the office-based computer you want to control the *host* computer. The home machine at whose keyboard you'll be sitting will be called the *remote* computer. Using PCREMOTE, the remote computer will always access and operate the host computer.

After the modem link between the two machines has been made and your password verified, keystrokes from the remote computer are sent to the host, and video data from the host is received and displayed on the remote screen. In essence, the keyboard and screen of the remote machine function as if they were the actual keyboard and screen of the host. To ensure that you'll be able to execute programs properly, care has been taken to see that all keyboard shift status information is correctly sent from the remote to the host computer; CapsLock, NumLock, ScrollLock, Alt, and Ctrl keys all function normally.

PCREMOTE does not interfere with the host's normal computer operations; indeed, its monitor and keyboard continue to function, allowing you to put PCREMOTE to additional uses. For example, you can use it to teach someone at another site how to use an application program on his machine. The student executes PCREMOTE, thus becoming the host. You then use the remote option of PCREMOTE to call the student's computer. Once the two machines are connected, data from either keyboard is accepted by the student's computer, and everything on the student's monitor is also displayed on the instructor's monitor.

■ You can access and operate your office computer from your home keyboard by using a modem and this time-saving utility.

Alternatively, by reversing the installation procedure so that you are the host and the student the remote (the previous host machine will have to be rebooted to do this), you can demonstrate a program stored on your computer. The student can then call your machine and test the program while the two of you examine its features together.

In deciding whether PCREMOTE will meet your needs, two limitations should be understood at the outset. First, the application programs you run remotely must be text-based rather than graphics-based. Second, while PCREMOTE allows you to run programs and to access and use files on another machine, it does not let you transfer files back and forth between your home and office computers. To do that, you need a combined control and communications program such as Dynamic Microprocessor Associates' *pcAnywhere*.

Instructions for downloading a ready-to-run copy of PCREMOTE from PC MagNet are given in the sidebar "PCREMOTE by Modem." Due to space considerations, we are not able to print the source code here. If you're interested in examining or modifying the program's source code, you can download the file PCREMOTE.ASM from PC MagNet. You also can get both the assembly and BASIC listings by mail or fax by sending a written request with your name, address, and fax number (if applicable) to Utilities, *PC Magazine*, One Park Avenue, New York, New York, 10016, Attention: Carolyn Falconer. (Note: estimated fax length is about 35 pages.) No phone calls, please.

To assemble PCREMOTE from its source code requires a macro assembler (IBM or Microsoft, Version 2 or later) and the following commands:

```
MASM DEBUGSCR;
LINK DEBUGSCR;
EXE2BIN DEBUGSCR DEBUGSCR.COM
```

USING PCREMOTE

As noted above, PCREMOTE is actually two programs in one. The "unattended" mode of the program is run on the host computer that will be accessed from a remote site. The "manned" mode is run on the remote computer that will initiate calls to the host. The relevant mode is selected as part of the program's syntax, as follows:

```
PCREMOTE [/M] [/2] [/P] [/D]
```

If you enter the above *without* the /M switch parameter, PCREMOTE will default to the unattended mode of program

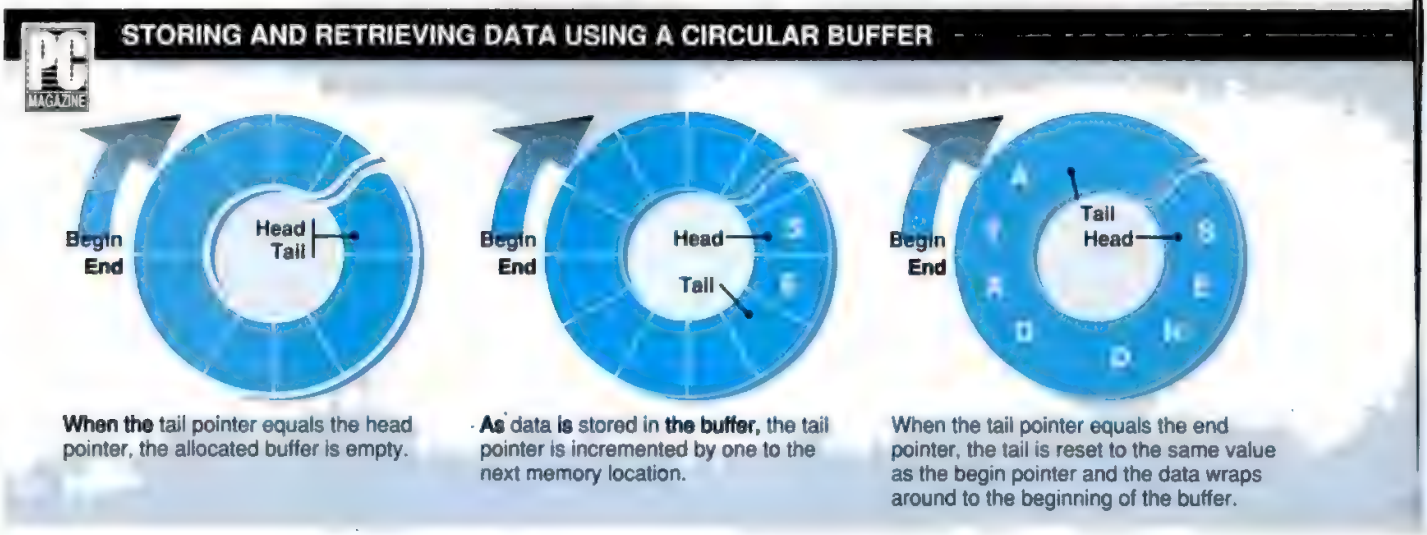


Figure 1: The characters SEND_DATA are used here to illustrate how a circular buffer stores and reads data.

operation and will install itself as a RAM-resident program running in the background. As explained below, PCREMOTE /M is used to execute the program in its manned mode—that is, from the remote computer.

PCREMOTE recognizes three additional command-line switches, which are used to toggle the program's default parameters. The program defaults to 1,200-bit-per-second operation through the COM1 port. Using the /2 switch causes the program to use COM2. The /F (fast) switch tells PCREMOTE to use 2,400 rather than 1,200 bps. If PCREMOTE is configured for 2,400-bps operation using a 2,400-bps modem, it will accept calls at either 1,200 or 2,400 bps. The /D option is used only when running the program on a machine equipped with a CGA video board that exhibits snow when executing PCREMOTE. The switch enables desnow logic, though at the cost of some screen-writing speed.

When you execute PCREMOTE *with* the /M switch, it will initialize the modem and ask you for the phone number of the remote computer. After the modems have connected, the screen will be cleared and you will be presented with an "Enter password:" prompt. You are given three tries to enter the correct password. The default password provided with the program is PC MAGAZINE. (You can change the password before running the program, using the procedure that is described later in this article under the heading "Customization." There is enough space allowed for a password of up to 20 characters.)

When the correct password is entered, the host computer begins to update the screen of the remote computer so that the two displays are the same. You can enter data at any time, even while the screen is being updated.

Once your work on the host computer has been completed, you can exit PCREMOTE by hitting Alt-x, which brings up a window to confirm that you want to exit. Answering anything other than yes here will return you to PCREMOTE. Entering Y sends the Alt-x keystrokes to the unattended computer, and both programs then hang up their phones and reinitialize their modems. The screen on the remote computer will be blanked, and the host computer will return to DOS.

Remember, however, that exiting PCREMOTE will not affect any program running on the host computer in unattended mode. To keep your phone bill down, it's possible to start a task on the host computer and exit PCREMOTE, letting the processing finish on the host while you do something else. You can call the host computer at intervals to see whether it's through.

There's one potential problem you might encounter when printing a document from the remote computer: running out of paper. Always make sure that your office printer's paper supply is well stocked before leaving it unattended.

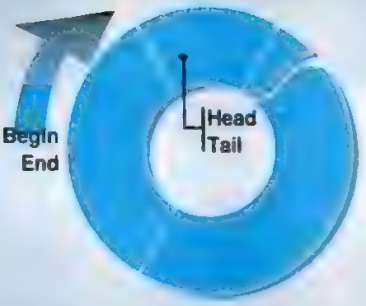
PCREMOTE has been tested and found compatible with a variety of popular programs, including *Lotus 1-2-3*, *The Norton Utilities*, *dBASE III Plus* and *dBASE IV*, *Microsoft Word*, *WordStar*, *WordPerfect*, and *PC Tools Deluxe*. The one caution to observe is to make sure that programs such as *Microsoft Word*, which can run in either graphics or text mode, are properly switched to text mode. If they aren't, you'll get either a blank screen or garbage and it will be very difficult to return to text mode. Obviously, this also means that it is not possible to run *Windows* and similar software. Also bear in mind that some programs, such as *Lotus 1-2-3*, create their own cursors. This means that you will be entering data without the aid of a cursor during editing of cell entries.

Some RAM-resident programs on the host computer will not operate because they require activation through interrupt 9, the keyboard hardware interrupt. On the other hand, both *SideKick* and *SideKick Plus* pop up normally on the host computer and are properly displayed on the remote computer.

The way in which remote screen updating takes place will at first seem strange, so you should start by experimenting with some familiar programs. Try issuing the DIR command, for example. You'll find that scrolling changes only the top line or two until the computer stops scrolling, but at that point the screen will be properly displayed.

Perhaps the hardest thing to get used to, however, will be having to remember that everything you do is actually being performed on the *host* computer, *not* on the machine at which you're sitting. The DIR

To retrieve data from the buffer, the head pointer is incremented by one.



Again, when the head pointer equals the tail pointer, the buffer is empty.

command, for example, will display the directory of the *other* computer's disk. To regain direct access to your own machine, you'll have to exit PCREMOTE.

If you are using a 1,200-bps modem, you should be sure to read the section "Data Carrier Detect" below. If for some reason the Data Carrier Detect (DCD) signal is not enabled, your computer may seem to lock up. The section on Data Carrier Detect describes how to ensure that your modem is properly configured.

HOW PCREMOTE WORKS

In understanding PCREMOTE, the place to start is with the timer tick. The system hardware timer generates an interrupt 18.2 times per second. Changing the timer interrupt so that it executes PCREMOTE is the only reliable way to enter the host-resident portion of PCREMOTE.

The interrupt 8 handler executes the old interrupt routine and checks to see if the host program is active. If not, it sets the active flag and checks to see if the remote system is connected. If there is no connection, the CONNECT_UNATTENDED routine is executed to check for a connection and request the password. A correct password leaves the connect flag set and exits the CONNECT_UNATTENDED routine. If the connect flag is set, the UNATTENDED routine is executed.

The CONNECT_UNATTENDED routine checks for a carrier signal and, if one is present, it goes on to check for carriage return codes. If 5 out of 10 bytes are not carriage return codes, the routine assumes it must switch to 1,200 bps. This provides a method of automatic bps rate detection when using a 2,400-bps modem. The remote system sends 20 carriage returns at 1-second intervals to provide the bps rate synchronization. The host system sends the "Enter password:" message and waits for the password. The unattended system will send 5 NULL codes after it verifies the correct password. These NULL codes cause the manned system to branch into the manned routine to process video data and keystrokes for normal PCREMOTE communications.

After the connection is established, the "Enter password:" message is sent to the manned computer, where it is received and checked. If the password is correct, the routine is exited, leaving the connect flag set. Otherwise, the phone is hung up and the modem is reinitialized. During the password checks, the carrier signal is monitored for loss of carrier. This prevents system lock-up if someone calls the system by mistake.

The UNATTENDED routine compares video RAM with a video RAM copy to determine if any changes have occurred in the video data. A change creates a 16-byte block of character or attribute data for transmission to the remote system. 18 bytes of data are kept in the output buffer to ensure that enough data is always available for transmission to the remote system between timer ticks. At 2,400 bps, approximately 13 bytes of data can be transmitted between timer ticks.

The INPUT_PROCESSING routine decodes the data being sent from the remote computer and puts it into the host machine's keyboard buffer. A loss of carrier or receipt of Alt-x hangs up the modem and resets the unattended portion of PCREMOTE.

CIRCULAR BUFFERS

PCREMOTE makes use of two circular buffers: one for incoming data and the other for data to be sent through the serial port. Each buffer has four pointers: head, tail, begin, and end. When the head pointer equals the tail pointer, the buffer is empty. Data is stored in each location pointed to by the tail pointer. Data is retrieved sequentially, starting at the location pointed to by the head pointer.

As data is stored and retrieved, the appropriate head or tail pointer is incremented to the next memory location. If this exceeds the end of the reserved memory space, the pointer is set to the beginning of the buffer, thus creating a circular buffer. If the tail is one less than the head, then the buffer is full.

The diagram in Figure 1 shows how the characters SEND_DATA are stored in a circular buffer. The S is stored in the location pointed to by the tail pointer, which is then incremented by one. This process is continued until all of the characters are stored in the buffer. Note that when the tail pointer is equal to the end pointer, the tail is reset to the same value as the begin, which causes the data being stored to wrap around in a circular fashion.

To get data out of the buffer, the head pointer is used. As the data is retrieved, the head pointer is incremented. This process can be continued until the head pointer is equal to the tail pointer, at which point the buffer is empty.

The two buffers are serviced by two routines. GET_BUFF_DATA retrieves data from a buffer, and PUT_BUFF_DATA stores data in a buffer. The AH register is used to indicate whether the input or the output buffer is to be used. The availability of data in the GET_BUFF_DATA routine is indicated by the carry flag. The PUT_BUFF_DATA uses the carry flag to signal that the output buffer is full.

THE KEYBOARD

Keyboard data from the remote system is formatted before being sent to the host computer. First, the value FEh is sent, which tells PCREMOTE that the next 2 bytes contain keyboard data. The next byte contains the ASCII code, and the last byte contains the scan code. After decoding,

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CUSTOMIZING YOUR HOTKEY — **COMPLETE LISTING**

```
DEBUG PCREMOTE.COM
-E21C xx <--------------Substitute hex code of desired character for xx
-W
-Q

Alpha Characters:   A  B  C  D  E  F  G  H  I  J  K  L  M  N  O  P  Q  R  S  T  U  V  W  X  Y  Z
Hexadecimal Codes: 1E 30 2E 20 12 21 22 23 17 24 25 26 32 31 18 19 10 13 1F 14 16 2F 11 2D 15 2C
```

Figure 2: The default key used with Alt to exit PCREMOTE is x (Alt-x). If Alt-x conflicts with a TSR program, the short DEBUG script above lets you change this to any other key: simply substitute the proper hex value for the desired character at *xx*.

this data is put into the keyboard buffer of the host computer, where even programs that do not make use of the BIOS services will be able to access it.

If the shift status changes, an FDh value is sent to indicate that the next byte contains shift status data. This is stored in address 0040:0017H of the host computer, which is the address of the BIOS data area that contains current shift-key status information. Keeping this information updated ensures that the host computer always has the correct shift-key information.

The keyboard buffer maintained by the BIOS is also a circular buffer. The head pointer is stored at address 0040:001AH and the tail pointer is stored at address 0040:001CH. The buffer itself begins at address 0040:001EH and ends at address 0040:003EH. Keyboard data from the manned (remote) computer is put into the keyboard buffer of the host through a routine that is similar to the PUT_BUFF_DATA routine listed in the source code.

INTERRUPT-DRIVEN I/O

The COM port interrupt service routine reads the interrupt ID register to determine whether the interrupt is being caused by receive data or by transmit buffer empty. Receive data is stored in the input buffer. Transmit buffer empty gets a byte of data from the output buffer and sends it to the COM port. If the output buffer is empty, the COMM_INT_STA flag is reset. When data is placed into the output buffer, the COMM_INT_STA flag is checked. If it is reset, data is forced out of the COM port. This has the effect of "kick starting" the transmit interrupt.

VIDEO FORMATTING

Video data from the host is formatted before being sent to the remote computer. The standard 25-row by 80-column display requires 4,000 memory locations for storage. Each character displayed requires 2 bytes of information. The first byte in memory is the ASCII character to be displayed, and the second is the "attribute" of the character. The attribute byte defines the foreground color, background color, intensity, and blink attributes of the character.

Data is sent to the remote system in blocks, and a block is made up of character data or attribute data. In the host computer, a block of 16 words is read from the video RAM and compared byte by byte with the video copy maintained by PCREMOTE. If the data doesn't match, a loop counter determines if it is character data or attribute data. The transfer block routine sends the appropriate sync byte—FFh for attribute data, FEh for character data. The block number is sent after the sync byte to identify the location of the block in memory. The block number is followed by the 16 bytes of data from the block.

The first byte of video data sent to the remote system provides a method of synchronization between the two systems. Noise on the phone line between blocks will be ignored by the remote system. The least significant bit of the sync byte is used by the remote system to address character data or attribute data in the remote video RAM. The remote system multiplies the block number by twice the block size to determine the video RAM address of the block.

The host program also checks the current cursor position with the last known position of the cursor. If the position is different, the new position is sent to the remote computer. The sync byte D2h is sent first, followed by the cursor column and the row. The remote system decodes the data and uses the BIOS video interrupt to set its cursor position correctly.

CUSTOMIZING YOUR PASSWORD — **COMPLETE LISTING**

```
DEBUG PCREMOTE.COM
-E1F3 'NEWPASSWORD'   ;new password
-E1F1 B               ;size in hex
-W
-Q

Length in Decimal: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Hexadecimal Value: 1 2 3 4 5 6 7 8 9  A  B  C  D  E  F 10 11 12 13 14
```

Figure 3: You can use the DEBUG script shown above to change your PCREMOTE password. The new password may be up to 20 characters long, and its length must be entered in hex where indicated. Be sure to enclose the new password in single quotes, as indicated. (The quotes are not included in determining the password's length.) This example changes the password to NEWPASSWORD, which has a length of Bh (11 decimal).

CGA SNOW

PCREMOTE accesses video RAM directly on the host and remote computers, and this can cause "snow" when used with certain CGA cards. If you encounter this problem, simply add the /D switch to the command line when you execute PCREMOTE. When the "de-snow" option is used on the host computer, it slows the program slightly; this is because during the

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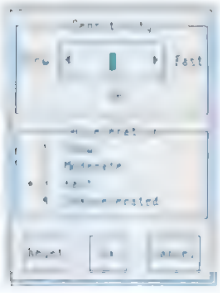

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CIRCLE 378 ON READER SERVICE CARD

PCREMOTE BY MODEM

The programs published in *PC Magazine* are available by modem from PC MagNet.

To join PC MagNet, set your communications software for either 300 or 1,200 bits per second, 7 data bits, even parity, 1 stop bit, and full duplex. To find the number nearest your dialing exchange, dial (800) 346-3247. When the modem connects, press Enter. At the HOST NAME prompt, enter PHONES. Follow the menus and note the number closest to you.

After you have found the phone number nearest you, hang up and redial using that number. When you connect with PC MagNet, press Ctrl-C. At the HOST NAME prompt, enter CIS. At the USER ID prompt, enter 177000,5000. Enter PC*MAGNET at the PASSWORD prompt and Z10D9001 at the ENTER AGREEMENT NUMBER prompt. For Customer Service, call (800) 848-8990; outside the United States, call (614) 457-8650.

To download PCREMOTE.COM and its assembly or BASIC listings, log on to PC MagNet. Enter GO UTILITIES or choose PC MAGAZINE UTILITIES from the top menu, then DIRECT UTILITY DOWNLOAD from the next menu. Enter the filename, then select the file you want to download from those presented. Answer yes (Y) to DO YOU WISH TO DOWNLOAD? Press Enter to see the transfer protocols. Choose a protocol and download the file.

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PCREMOTE Command

Terry Lahman — January 16, 1990 (Utilities)

Purpose: To permit accessing and operating an off-site computer from your own keyboard by using a modem link.

Format: `PCREMOTE [/M] [/2] [/F] [/D]`

Remarks: PCREMOTE is actually two programs in one. Entered without the /M switch, it becomes RAM-resident on the off-site computer to be controlled. This machine and its modem must be left powered on to receive calls, but they may otherwise be used normally or left unattended.

To gain access to and control over the off-site computer, execute PCREMOTE /M from the command line of your own machine. You will be prompted to enter a phone number, which will then be dialed automatically. Upon connection, the off-site computer will prompt you for a password, which you must enter correctly within three tries. The default password is PC MAGAZINE (see the note below).

After password verification, you can execute all *text-based* (nongraphical) programs on the off-site computer by entering the appropriate keystrokes at your own keyboard. (The keyboard of the off-site machine remains active, as well.) All screen displays that appear on the off-site machine will also appear on your monitor.

To terminate PCREMOTE, enter Alt-x and confirm your intention by responding yes at the prompt window. Both computers will then hang up the phone and your machine will return to DOS. The off-site computer will continue to execute any program that was begun before PCREMOTE was terminated. The off-site machine can thus print out large files while you are off-line, given sufficient paper.

PCREMOTE defaults to COM1 at 1,200 bits per second. Using the optional /2 switch on its command line will engage COM2 instead of COM1. Similarly, the /F switch sets the bps rate to 2,400. If you are using a CGA card and snow is a problem, use the /D (De-snow) option on the command line.

Note: You can change your password with DEBUG. A new password of up to 20 characters may be entered, within single quotes, at address 1F3h of PCREMOTE.COM. The length of the new password (not including the single quotes) must also be entered, in hex, at address 1F1h.

block transfer from video RAM, the program waits for horizontal sync before transferring a byte of data from the video RAM. Using the de-snow option is necessary only if someone will be watching the screen of the host computer—during a training session, for example. Using the de-snow option on the remote computer does not affect program execution speed.

CUSTOMIZATION

If the default exit hotkey (Alt-x) conflicts with one of your TSR programs, you can change to another Alt-key combination with DEBUG. The hexadecimal scan code for PCREMOTE's exit is stored at address 21Ch. Using the DEBUG commands shown in Figure 2, you can change the exit key from Alt-x to any of the other alpha characters by substituting the appropriate hexadecimal scan code.

You will also need to use DEBUG to change your password from the default PC MAGAZINE to something more secure. The program will accommodate a password of up to 20 characters. When making your changes with DEBUG, be sure to enter the new password in uppercase, as PCREMOTE converts any password it receives from the remote computer to uppercase.

In addition to entering the new password itself, you must update the size of the password so that the program will know how many characters are to be checked. The password is stored at address 1F3h, and the size of the password is stored at address 1F1h. The DEBUG script in Figure 3 shows the sequence of DEBUG commands required. The example shown in Figure 3 changes the password from PCMAGAZINE to NEWPASSWORD.

DATA CARRIER DETECT

Data Carrier Detect (DCD) is a signal sent from a modem to a computer that indicates the status of the modem carrier. When a carrier is present, DCD will be active, indicating that two modems are communicating via a phone line. When the carrier is lost, DCD will become inactive. PCREMOTE requires that you configure your modem DCD setting to follow the status of the carrier.

Most 1,200-bps modems have a switch that lets the DCD line be set either to follow the carrier condition or to force DCD true (on). Make sure your modem's switch is set so that DCD follows the carrier. If instead you set the switch to force the DCD signal true (on), PCREMOTE will appear to lock the computer when you load the program in host mode. The reason is that PCREMOTE will think it is connected to a remote system and will wait for a password that never arrives.

In the remote mode, the same mistake will cause the screen to go blank right after you enter the phone number instead of waiting until the modems connect.

For a Hayes Smartmodem 1200, switch 6 must be up to enable DCD. The DCD signal for 2,400-bps modems is programmable. The &C1 in the MODEM_SETUP3 string is the command that enables DCD to follow the carrier. Modems operating at 1,200 bps will ignore this command.

In the host mode, PCREMOTE tests DCD after each timer tick to see if a connection with a modem has been established. In the remote mode, PCREMOTE tests DCD to see if the host computer has

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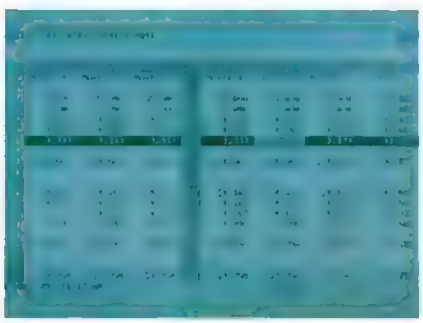

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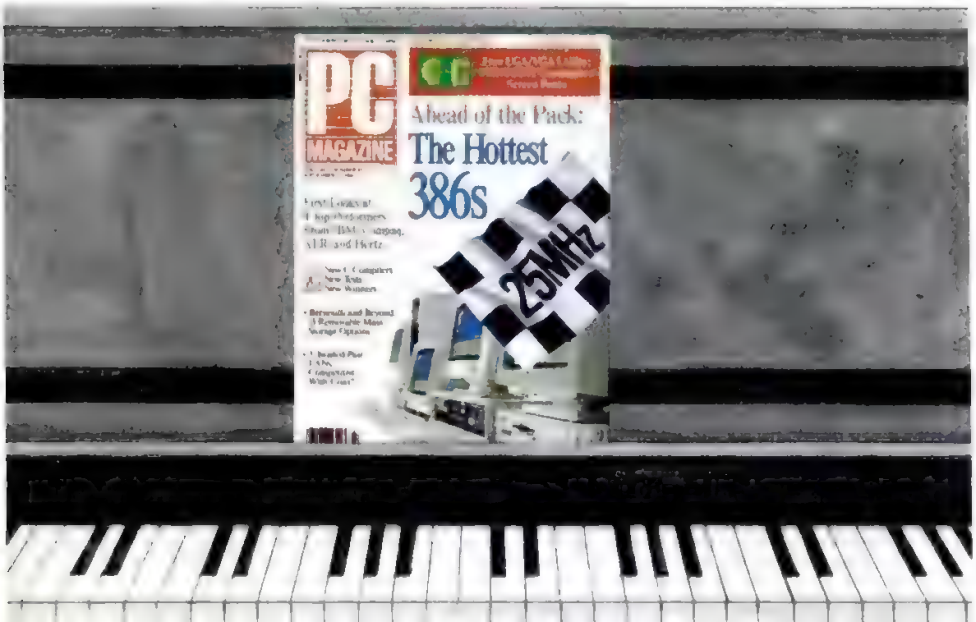
answered the phone. During phone communications, both modes of operation continually check DCD for loss of carrier. If phone communication is interrupted, PCREMOTE will reinitialize the modems and, in the host mode, will test for the next incoming call.

ENHANCEMENTS

Because PCREMOTE was originally designed to attach a remote terminal to a host computer, I included no provisions for communicating with the actual remote PC at which you will be working. Thus, while running PCREMOTE, you cannot access any of the floppy disks or hard drives on the remote machine. That's why you cannot exchange files between the two systems. You cannot download from the host to the remote computer, and you cannot upload from the remote computer to the host. For the purposes for which PCREMOTE was designed, these additional functions were simply not needed.

The additional functionality can certainly be added to PCREMOTE, but to do so would go beyond the scope of this article. Readers who follow the programming aspects of PCREMOTE can certainly try adding such functionality, and perhaps if there's interest enough, I'll add this feature to a future version of PCREMOTE.

Terry Lahman is manager of customer support for Dataproducts Corp. of Woodland Hills, California.

Observant readers will no doubt have noticed that several of our recent utilities have dealt with communication via modem and phone line. With the cost of reliable modems hovering between $55 to $60, the message should surely be clear. If you haven't done so, it's time to embrace communication by electronic means.

PC MagNet, MCI Mail, CompuServe, BIX, and the many local bulletin boards throughout the country will open up a new world—there's a lot of worthwhile exploring to be done. One of our goals is to demystify the traditional (and often imaginary) difficulties associated with the topic of communications. Toward that end, we look forward to seeing your letters—with ideas and suggestions for communications-based utilities, as well as with your comments and questions.—Tony Rizzo ■

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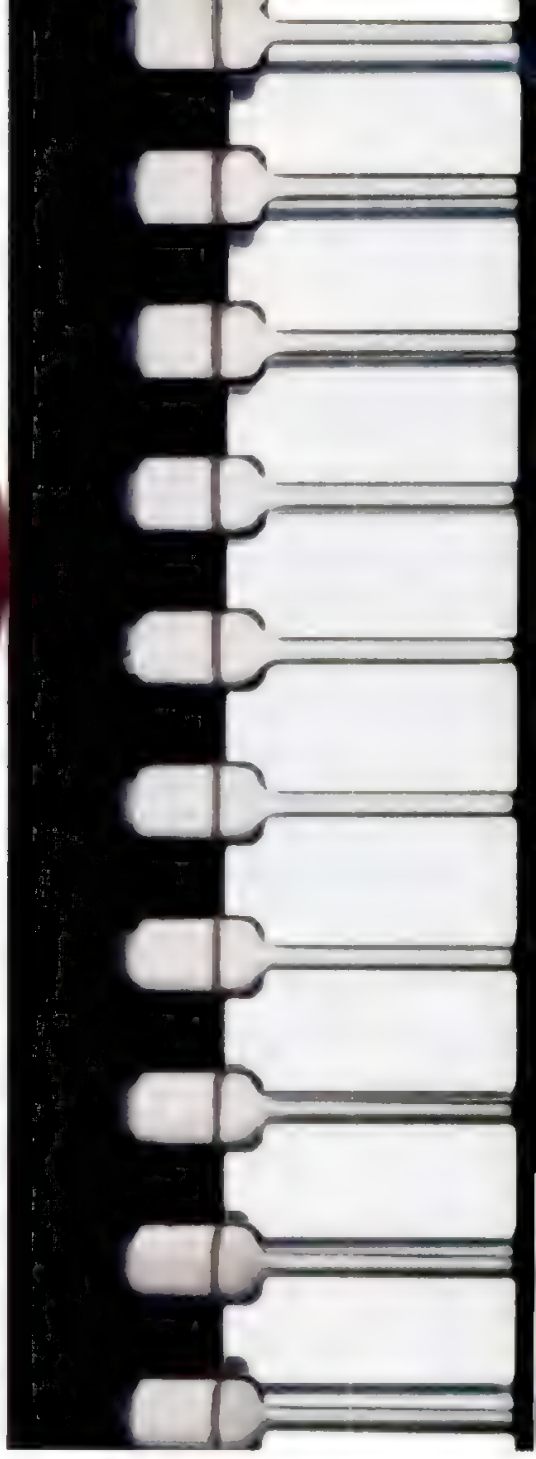

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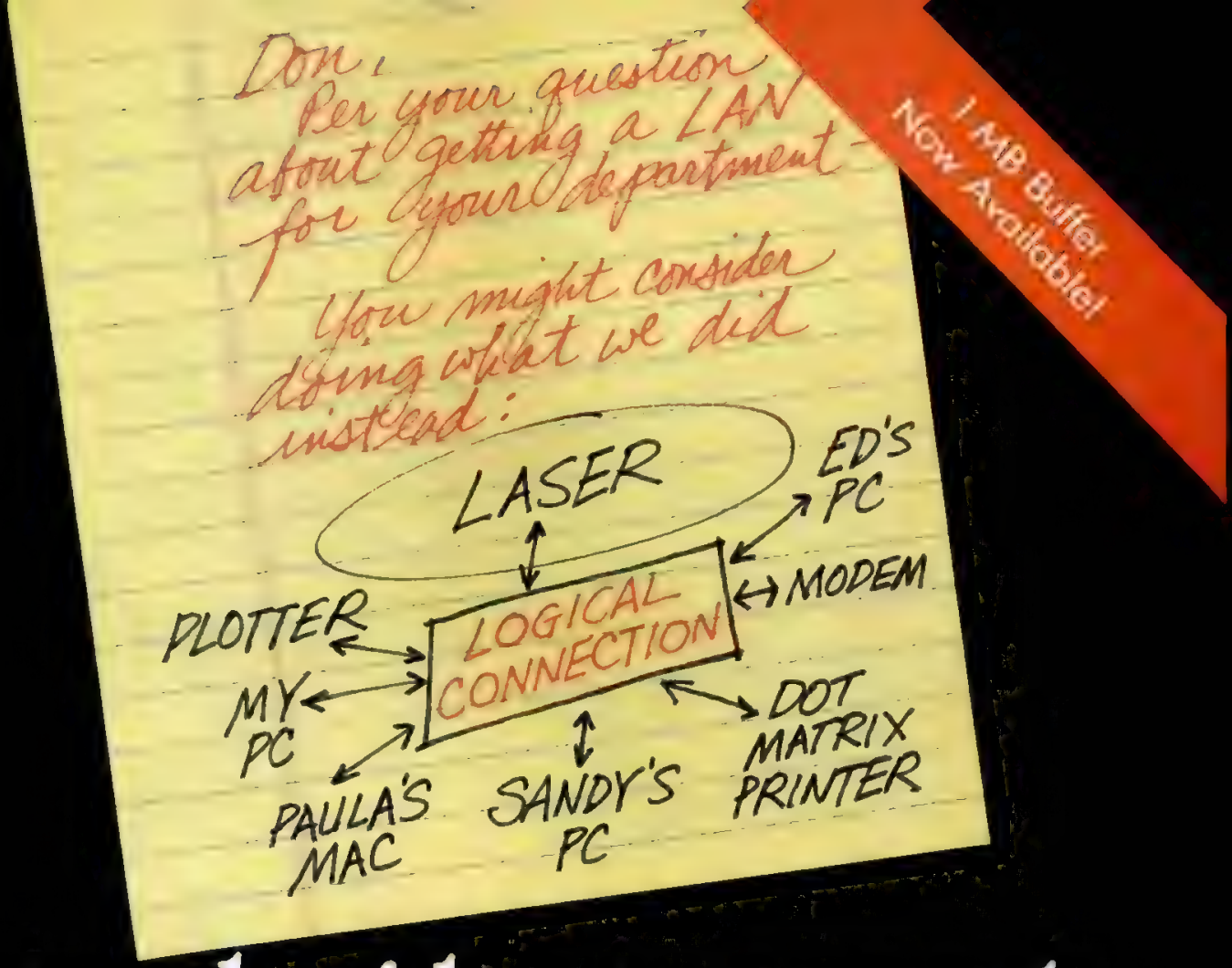

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by
Charles Petzold

Environments

OS/2 and the 386: They Should Have Been Made for Each Other

Three years ago, when Compaq and a number of other companies began shipping the first 80386-based PCs, *PC Magazine* began a crusade. Should the message have missed you, it's that we strongly believe that you should avoid buying 80286-based machines and get on the 386 bandwagon instead. We see the 386 becoming the standard for corporate computing.

Some of our readers have accused us of being crazed power-junkies who have no regard for the budgets and needs of the average PC user. The fact is, however, that our recommendation is based on the realization that the personal computers purchased by corporations today must be used for five years or so. This period encompasses the time during which we're likely to see a transition from DOS to OS/2.

Even for DOS, of course, the 386 has capabilities—beyond sheer horsepower—that make it a better choice than the 286. A DOS multitasker that makes use of the Virtual-86 mode of the 386 is much more stable and versatile than one that does not, for example. In OS/2, the 386 will give us the ability to run multiple DOS programs and much more besides.

In this column, I'll discuss the capabilities of the 386 as they will affect OS/2 2.0, the first version of OS/2 that explicitly supports the 386 microprocessor. As of mid-September, as I write this column, the only commitment Microsoft will make is that OS/2 2.0 will be released on the retail level sometime in 1990. Current speculation indicates mid-1990. Microsoft has promised programmers beta versions of OS/2 2.0 by the end of 1989. By the time this issue is in your hands, you'll probably know whether they were able to meet this promise.

OS/2 AND THE 286

Do you need a 386-based machine to run OS/2? Definitely not. I've been running various beta and retail versions of OS/2 on my 8-MHz IBM PC AT Model 339 since November 1986. With a few enhancements (a second 30MB hard disk and a 4MB memory board), OS/2 gives satisfactory performance on this machine.

- Maintaining compatibility between 16-bit segmented-memory programs and 32-bit flat-memory programs turns out to be a bigger job than we originally bargained for.

I must confess, however, that I've run OS/2 on that 8-MHz AT partly in order to prove that the more than 10 million 286s currently in use *are* adequate OS/2 machines. Many of them will need a few more megabytes of memory, and the old monochrome adapters and displays will have to be replaced with EGAs or VGAs and a color display. But OS/2 was designed for a 286 and runs just fine on one.

Indeed, versions of OS/2 through 1.2 have no special code that even takes advantage of a 386 microprocessor, except for switching more quickly from protected mode (the mode used to run OS/2 programs) back to real mode (required for DOS compatibility).

Protected mode is what makes OS/2 possible, for it gives the 286 microprocessor access to 16MB of physical memory and provides the protection and task switching needed for safe multitasking. Most OS/2 users are currently running the operating system with 3MB to 8MB, so the 16MB maximum offers sufficient headroom for the immediate future. In addition, OS/2 supports virtual memory (the use of hard disk space for spillover from physical memory), so OS/2 applications can use more memory than is physically present in the system.

At the moment, then, the only advantage of a 386 over a 286 in running OS/2 is speed. The performance increase results primarily from the higher clock speeds of the 386 microprocessor, from its wider data path, and from the reduced clock cycles required for some instructions.

NEXT YEAR'S MODEL

If you don't *need* a 386 to run OS/2, will you really *want* a 386 for OS/2? Yes. Definitely. Without a doubt. The enhancements that Version 2.0 will bring to OS/2 will represent a significant improvement over the earlier 286 version. *PC Magazine*'s editor-in-chief, Bill ("the 286 is brain-damaged") Machrone, has already begun to label OS/2 2.0 as the first *real* version of the operating system and the version that will drive the final nails into the 286's coffin.

Toward the end of this column, I'll also speculate a bit about what I think will happen to the OS/2 market when OS/2 2.0 is released. First, however, let's take a look at what this new version will have to offer. A combination of public statements by Microsoft and some inside information reported by the trade weeklies makes such a preview possible.

16-BIT AND 32-BIT

Like the 8088 used in the original PC, the 80286 is a 16-bit microprocessor. All the

286's registers are 16 bits wide. Under real mode, the 286 can use 20 bits to access 1MB of memory, but this 20-bit address is derived from two 16-bit registers. The classic diagram showing how a 16-bit segment register is shifted left 4 bits and then added to a 16-bit offset address to form a 20-bit physical address is by now so familiar that I won't bore you by repeating it here.

This form of memory segmentation was one of the ways in which Intel provided a reasonably smooth transition from the 8080 microprocessor (which used a 16-bit address to access 64K of memory) to the 8086 and 8088. In these later processors, each segment is 64K in length and is addressable with a 16-bit offset. The starting position of this segment in the 1MB of physical memory is governed by the segment register.

In protected mode, the 286 has four more address lines available, bringing the total to 24 bits, which translates into 16MB of physical memory. In 286 protected mode, the segment address is virtualized. It's basically an index into a table that provides a 24-bit base address for the segment.

But we're still stuck with the 64K segment limit imposed by the 16-bit offset register. Thus, the 286 is still hopelessly a 16-bit microprocessor, and the current versions of OS/2 must suffer under that restriction.

On the other hand, a 386 operating in protected mode is a real 32-bit microprocessor. The registers are 32 bits wide and the processor uses 32 bits for accessing physical memory. The 386 version of OS/2 will allow programs to take advantage both of these wider registers and of the larger addressable memory.

Microsoft has promised that the 386 version of OS/2 will run all programs written and compiled for the 286 version of OS/2, however. In addition, the 386 version of OS/2 will run new programs compiled specifically for the 386. For convenience, people are beginning to refer to these two program types as "16-bit programs" and "32-bit programs." A *16-bit program* is one that has been compiled for the 286 version of OS/2, using the 286 instruction set. A *32-bit program* is one that has been compiled for the 386 version of OS/2, using the 386 instruction set.

For some small and simple programs, you may be able to compile a 16-bit program and a 32-bit program from the same source code. All you'll need to do is recompile and relink the program using different compiler and link switches. Larger and more-complex programs may require some modification before they can be successfully recompiled as 32-bit programs, however.

From the programmer's perspective, a 16-bit program and a 32-bit program differ in a number of ways. Because C is currently the most popular language for OS/2 programming, I'll use it here to provide an example.

In a 16-bit program, the `int` data type is 16 bits wide; in a 32-bit program, an `int` is 32 bits wide. This change is normal and is based on the definition of an `int` in C as the machine's natural register size. In 32-bit programs, the size of the `short` and `long` data types will probably remain the same as in 16-bit programs—16 bits wide and 32-bits wide, respectively. Thus, in a 16-bit program, a `short` is the same as an `int`. In a 32-bit program, a `long` is the same as an `int`.

> The 386 version of OS/2 will allow programs to take advantage both of the 386's wider registers and of its larger addressable memory.

A 16-bit program can allocate a block of memory up to 64K in length—the maximum size addressable with a 16-bit offset register. (This is not *entirely* correct. In recent years, C compilers have defined a data type called `huge` for data items that require more than 64K. The 286 version of OS/2 also supports allocation of `huge` memory blocks. However, because they require multiple 64K segments, there are some restrictions on the use of `huge` data items, and performance is degraded.)

In theory, a 32-bit program can allocate a block of memory up to 4GB (4 billion bytes) in length. But this is not precisely correct either. The actual limit—based on both OS/2 2.0 architecture and machine resources—will certainly be less than this. Let's just say for now that the 64K segment limit disappears in 32-bit programs; whatever the new limit is, it will be sufficient.

Indeed, for reasons I'll explain shortly, the whole concept of segments will disappear in OS/2 2.0 programs. Source code for 32-bit programs will not make use of keywords such as `near`, `far`, and `huge`.

When you compile a 32-bit program, the compiler can generate machine code that uses the 386 instruction set, including the 32-bit registers and 32-bit addressing. This is a pretty obvious difference between 16-bit and 32-bit programs.

Something that may not be quite as obvious, however, is the difference in how 16-bit and 32-bit programs will handle the stack. When a C program makes a function call, the compiler generates code that pushes all the arguments on the stack and then calls the function. The stack is aligned on `int` boundaries. What this means is that each parameter pushed on the stack occupies either the space required for an `int` or an integral multiple of that space. When an 8-bit `char` item is pushed on the stack, for example, it is padded to occupy the same space as an `int`.

Thus, the change from a 16-bit `int` to a 32-bit `int` means that the parameter stack will be different in 16-bit and 32-bit programs. Normally this would not be a problem, for it is invisible to the programmer and is something only the compiler needs to worry about.

But consider for a moment how OS/2 programs make operating system function calls. They use this same stack mechanism. This implies that in order for OS/2 2.0 to run both 16-bit and 32-bit programs, it will have to handle function calls with two different stack formats.

THE SEGMENT HASSLE

The segmented architecture of Intel microprocessors has been a perennial headache for programmers. If all the code and data of a program can fit into 64K (the classic .COM format popular in DOS assembly language programming), you don't have to worry about segments. Otherwise, however, they're a mess—particularly if a single array of data is larger than 64K.

For users, the 64K segment limit continues to affect program functionality. Even applications that can deal with docu-

ments over 64K in length (and most can these days) often have some other limitation related to the 64K segment limit. For example, cut-and-paste operations are often restricted to 64K.

Performance suffers when programs deal with memory blocks that occupy multiple segments because the program must contain special code that hops between segments. For example, the current version of OS/2 can quickly display a bitmap less than 64K to the screen, but slows down when the bitmap is larger than one segment.

Segments have certainly been a problem for C. In Microsoft C 5.1, we now have four special keywords (`near`, `far`, `huge`, and `_loadds`) specifically for working with segments. Some C compilers have up to six different sets of libraries for various program memory models (tiny, small, compact, medium, large, and huge).

Segmentation also affects the portability of code written in high-level languages for the PC. Although non-Intel processors sometimes have segmented memory architectures, nobody does it quite the same way that Intel does.

BIG AND FLAT

The protected mode of the 386 changes all that by increasing the maximum segment size from 65,536 bytes to 4GB (4,294,967,296 bytes). That's quite a big step up. It means that once again we can fit all program code and data into one segment.

A 386 protected-mode operating system can support two different memory architectures: segmented or flat. It can also support a combination of the two.

In the segmented memory architecture, the application continues to use different segments for program code, data, and allocated memory, just as in a 286 protected-mode operating system. The only difference is that the segments are a great deal larger.

In the flat (or linear) memory architecture, the operating system provides one segment for all program code and data. Just as in a DOS .COM program, the program doesn't have to worry about segments, because everything fits into a single segment and can be addressed with just an offset register. The difference is that the offset address is 32 bits rather than 16 bits.

IBM and Microsoft have decided to go with the flat architecture for new 32-bit programs that have been written for OS/2 2.0. OS/2 2.0 will also support the segmented architecture that is needed to run the existing 16-bit programs that were written for the 286, however. Although segmentation makes some memory management easier for the operating system, the flat address space provides a significant benefit for the future portability of OS/2 and its applications to other processors. Flat memory architecture also simplifies OS/2 compilers for the 386 because only one memory model is required.

NEW MEMORY MANAGEMENT

Memory management in the 286 version of OS/2 is based on segments. When OS/2 needs to allocate a memory segment bigger than the largest free area in memory, it must move whole segments in physical memory to consolidate free space. If this doesn't open up a contiguous memory

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block of sufficient size, then OS/2 must discard code segments from memory (these must later be reloaded from the .EXE or .DLL file if needed) or save data segments to a swap file.

All the memory management, then, is based on whole segments, which may be as large as 64K. It is the responsibility of the programmer to ensure that the program cooperates with this segment-based memory management.

For example, a program that has many large code segments but that routinely uses only a small part of each of them is not cooperating, as each of the code segments must be present in memory for the program to do anything.

Memory management in the 386 version of OS/2 will be based on the 386 page-translation tables. When the 386 runs in protected mode, a linear memory address is formed by a 32-bit base address (indexed by a segment register) and a 32-bit offset register. These linear addresses map to physical memory through a page table. The pages have a granularity of 4K of physical memory.

By using page tables, a 386-based operating system never has to move memory blocks to consolidate free memory space; all it has to do is alter the page table. Other memory management (for example, discarding code and swapping data) is also based on these pages. This will help the performance of OS/2 programs whether they were written for the 286 or the 386 version of OS/2. But it is only possible when these programs are in fact running under OS/2 2.0 on a 386 microprocessor.

The 386 pages also help OS/2 regain some of the protection that segments provide, which is lost by moving to a flat address space. Pages can be marked as read-only in order to protect those that contain code or read-only data. Such pages cannot be written on by buggy code.

MULTIPLE DOS SESSIONS

The 386 also supports the Virtual-86 mode, which allows an operating system to run multiple DOS sessions in separate 640K memory blocks, to multitask these programs, and to trap all attempts that these programs might make to access the hardware of the computer directly.

Frankly, I have never been thrilled about the idea of running DOS applications under OS/2. It detracts from the real purpose of the operating system, which is to provide a platform for future applications that are better than those we currently use under DOS. However, I realize that many people see this feature as essential. And certainly, OS/2 should give users at least the functionality of *DESQview 386* and *Windows/386* in running multiple DOS applications.

As I discussed in the last issue, it has been rumored that Microsoft will attempt to come up with a way to run *Windows* 3.0 programs under the OS/2 2.0 Presentation Manager session. This is something I consider essential. *Windows* 3.0 is already being viewed as OS/2's biggest competitor. If OS/2 2.0 can run *Windows* 3.0 programs in addition to OS/2 programs and DOS programs, it will certainly be an attraction to those users who are now embracing *Windows* 3.0.

DLL COMPATIBILITY

Microsoft has promised that the 386 version of OS/2 will run OS/2 applications

MOVING?

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written for the 286. As I implied earlier, however, this is not quite as easy as it may at first seem.

Part of the problem is the stack. When a 16-bit program makes an OS/2 function call, the stack containing the function parameters is aligned on 16-bit boundaries. The stack of a 32-bit program is aligned on 32-bit boundaries.

This presents a problem for dynamic link libraries. In general, a 16-bit DLL written for the 286 version of OS/2 can handle calls only from 16-bit programs; likewise, a 32-bit DLL can handle calls only from 32-bit programs.

To solve this problem, the dynamic link libraries included with OS/2 2.0 will have two entry points, one for 16-bit programs and one for 32-bit programs. The entry point for the 16-bit programs must contain some code that realigns the stack on 32-bit boundaries and then calls the 32-bit entry point. It will also be necessary for this code to convert between 32-bit `far` addresses (16-bit segment and 16-bit offset) recognized by 16-bit programs and the 32-bit flat addresses recognized by 32-bit dynamic link libraries.

Most of the API in the 286 version of OS/2 should remain intact in the 386 version.

The dynamic link libraries in OS/2 2.0 will do this themselves. Microsoft will also be supplying programming tools to allow software developers to write their own DLLs that support both 16-bit and 32-bit programs.

API CHANGES

Most of the API (application program interface) in the 286 version of OS/2 should remain intact in the 386 version. If you are working with OS/2 you may have noticed that most of the function calls and structures are defined to use `short` and `long` integers rather than just plain `int`'s. In both 16-bit and 32-bit programs, the `short` is 16 bits wide and the `long` is 32 bits wide. These functions and structures will provide few problems in converting a 16-bit program into a 32-bit program.

However, there are some OS/2 function calls that deal explicitly with segments. These are principally the memory allocation functions (such as DosAllocSeg), but they also include a few others. It's not quite clear yet what will happen with these functions. I suspect they'll simply be outlawed in 32-bit programs and will be replaced with new functions for using the flat 32-bit memory space.

20-20 HINDSIGHT

Given the popularity of the 386, the big improvements we'll see in the 386 version of OS/2, and the problems involved in supporting both 16-bit and 32-bit programs under one operating system, wouldn't it have been better for OS/2 to have been a 386 operating system from the very beginning?

In retrospect, yes. But it's much easier to say that now than it was to make that decision back in 1986.

By the fall of 1986, development of OS/2 1.0 had reached the point where Microsoft was ready to let outsiders begin experimenting with it. The first 386 PCs were just being introduced around that time. IBM didn't introduce its first 386 machine until April 1987—the same day IBM officially announced OS/2—and it was not at all clear then that 386 machines would prove to be as popular as they have become.

Moreover, there were already millions of 286 machines that people had been buying since IBM's introduction of the PC AT in 1984. Undoubtedly IBM felt a strong obligation to provide these users with a protected-mode operating system. I suspect there would have been a lot of griping from AT owners if OS/2 did not run on these machines.

Still, it's becoming increasingly obvious that OS/2 will not be used very much on 286 machines. I see three reasons for this.

First, most 286 machines will require hardware enhancements (a larger hard disk, a memory expansion board, and a video adapter of EGA resolution or better) to run OS/2 adequately. By contrast, 386 machines routinely come with larger hard disks, more space on the system board for memory (usually 4MB to 8MB), and VGA adapters.

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performance and functionality of OS/2 2.0, they will realize that a 386 is the right machine for OS/2 and that a 286 is second-rate.

Third, and perhaps most important, it's likely that OS/2 will make its way into corporations not by replacing DOS on existing PCs but by being installed instead of DOS on new PCs. These new PCs will very likely be 386 machines.

My guess is that *Windows* 3.0 (which I discussed in this space last issue), rather than OS/2, will prove to be the more viable way to extend the life of DOS on existing 286 machines. That will allow users to get accustomed to the OS/2 look and feel on a 286 machine before moving to the real thing on a 386 machine.

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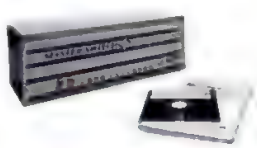

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It will be interesting to see how software developers perceive the market for their OS/2 applications. Some will release only 16-bit versions, aiming at maximum possible market penetration. Others will release both 16-bit and 32-bit versions. The bravest (or perhaps the most perceptive) will throw in the towel on the 16-bit versions and focus exclusively on the 386.

What is most disturbing, of course, is that we're still waiting for the 386 version of OS/2! By the time that is finally released, it will be more obvious than ever that designing OS/2 first for the 286 and then later adding 386 capability was unnecessary and wasteful.

Of course, back in 1986, if it had been up to me to make a decision about which microprocessor OS/2 should support, I too would have said "286 now, 386 later." In the past I believed that decision to be a good one, and I have said so in the pages of this magazine. It seemed more important to me to make the move to protected mode rather than to the 386.

What's different is that I'm now ready to admit that I was wrong. OS/2 *should* have been a 386 operating system from the very beginning. Period.

So let me add my vote to *PC Magazine*'s editorial mission: If you're thinking about buying a new PC that may someday run OS/2, don't get a brain-damaged machine. Get a 386.

AND THE 486?

It always seems that the software industry is one step behind the hardware folk. The first version of OS/2 was announced at the same time as IBM's first 386 machines appeared. OS/2 1.0 wasn't released until more than three years after the IBM PC AT was introduced. By the time OS/2 2.0 is released, it will be nearly four years after the first 386 machines, and by that time there will be several 486 machines on the market.

So when will we see an OS/2 for the 486? In 1993? Fortunately, it turns out that the 486 has very little direct impact on operating systems. Yes, it provides some performance benefits over the 386, but it doesn't have any architectural enhancements that affect operating system software. A 486 is basically a fast 386. OS/2 for the 486 is the same as OS/2 for the 386.

When OS/2 2.0 is released, IBM/Microsoft PC operating systems will finally have caught up to Intel's x86 line of microprocessors. We can then stop climbing the mountain and start enjoying the view. ■

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by
Ray Duncan

Power Programming

Arithmetic Routines for your Computer Programs, Part 5

■ Coprocessors first gave PCs the mathematical muscle of minis. Here's a look at how they work and how you can work them into your own programs.

One of the most forward-looking features of the original IBM PC was an undocumented, empty 40-pin socket located very close to the 8088 CPU on the motherboard. Despite IBM's lack of official comment, it didn't take long for people who looked at the machine's schematic to decide that this socket just *must* have been designed for Intel's new 8087 numeric coprocessor. In due course, some brave soul plugged an 8087 into the mystery socket, turned on the juice, and breathed a sigh of relief when nothing in his precious $5,000 64K PC went up in smoke as a result.

Word spread rapidly through the still-minuscule community of PC users that the IBM PC was 8087-capable, but a couple of years passed before large numbers of people started installing 8087s. When the first PCs were shipped in late 1981, 8087s were still very scarce (many of the available chips were buggy, temperature-sensitive engineering samples), cost over $400 each, and were regarded as difficult to program. Indeed, 8087s were considered so esoteric that a company called MicroWay built a successful business on buying the coprocessors in quantity from Intel and reselling them, with installation instructions, to anxious end-users who also valued the company's friendly telephone support, test programs, and hand-coded libraries for a few popular compilers.

The combination of the PC and the 8087 brought unprecedented number-crunching power to desktop computers. By itself, the IBM PC was barely faster at floating-point calculations than an Apple II or a Z-80 machine, but the addition of an 8087 made the PC powerful enough to handle many applications that had formerly required mainframes or minicomputers. The 8087 implemented the ANSI/IEEE 754 1981 Draft Standard for Binary Floating Point Arithmetic in a single integrated circuit. The standardized architecture of the PC/8087 combination and the potentially enormous user base also provided an attractive target market for microcomputer software developers, who had shown little interest in previous floating-point chips, such as the AMD 9511 and 9512.

The original 8087 worked with either the 8086 or 8088 processors and was first shipped in 1980. The 80287 was designed to work with the 80286 CPU and was the first of the Intel coprocessors to support memory protection and multitasking; it was shipped in 1983. The 80387 was designed to work with the 80386 CPU and was enhanced with several powerful new trigonometric instructions. After being brought into conformity with the ANSI/IEEE 754 Standard (as it was finally approved in 1985), the 80387 arrived on the scene in 1987. The 80387 is the last of its line—the 80486 has all of the logic of the 80387 built in and does not require a separate numeric coprocessor at all. The relative performance of the various 80*x*86/80*x*87 combinations is summarized in Figure 1.

(Note: Throughout the remainder of this column, I'll use "CPU" to refer to any member of the Intel 80*x*86 processor family (8086, 8088, 80286, 80386, or 80486), and "coprocessor" to refer to any member of the Intel 80*x*87 family (8087, 80287, or 80387). Statements intended to apply to a specific member of either product family will include an explicit reference to a particular model number.)

80x87 ARCHITECTURE

The 8087, 80287, and 80387 chips are called *coprocessors* because they are

INTEL COPROCESSOR HISTORY

Processor/ coprocessor	Typical speed	First shipped	Relative performance
8086 and 8087	5 MHz	1980	1
80286 and 80287	8 MHz	1983	2.5
80386 and 80387	20 MHz	1987	16
80486 with embedded 80387	25 MHz	1989	64

Figure 1: A comparison of the speeds, dates first available, and relative performance of the various combinations of Intel CPUs and their coprocessors.

closely coupled to the system's CPU, have a highly specialized instruction set, and cannot function alone. These coprocessors share the same data bus and address bus as the main CPU. They also monitor the CPU's instruction stream as it is fetched from memory and flows by on the data bus. Floating-point instructions all begin with a special escape code that is recognized and acted upon by the coprocessor. The CPU essentially ignores the floating-point instructions except to perform any needed address calculations on behalf of the coprocessor.

The shared instruction stream and the fact that many of the more complex coprocessor instructions can require hundreds of cycles to complete let careful programmers achieve some concurrent processing.

The shared instruction stream and the fact that many of the more complex coprocessor instructions can require hundreds of cycles to complete allow the careful programmer to achieve a certain amount of *concurrent processing*. A program can load a floating-point number onto the coprocessor, issue a floating-point square root instruction, and then execute several dozen CPU instructions in the 100+ cycles required for the square root operation to complete. The program can then resynchronize with the coprocessor and either unload the result of the square root operation into memory or use that result as an argument for the next floating-point operation.

Obviously, such concurrent program-

INSTRUCTION CATEGORIES FOR 80X87 COPROCESSORS

DATA TRANSFER	
FLD, FST, FSTP	Load or store floating-point value
FILD, FIST, FISTP	Load or store integer value
FBLD, FBSTP	Load or store binary-coded-decimal (BCD) value
FXCH	Exchange two coprocessor registers
ARITHMETIC	
FADD, FADDP, FIADDP	Floating-point add
FSUB, FSUBP, FISUB	Floating-point subtract
FSUBR, FSUBRP, FISUBR	Floating-point subtract reversed
FMUL, FMULP, FIMUL	Floating-point multiply
FDIV, FDIVP, FIDIV	Floating-point divide
FDIVR, FDIVRP, FIDIVR	Floating-point divide reversed
FSQRT	Floating-point square root
FSCALE	Scale one value by another
FPREM, FPREM1	Partial remainder (FPREM1 on 80387 only)
FRNDINT	Round to integer
FXTRACT	Extract exponent and mantissa from value
FABS	Absolute value
FCHS	Change sign of value
COMPARISON	
FCOM, FCOMP, FCOMPP	Compare two ordered values
FUCOM, FUCOMP, FUCOMPP	Compare two unordered values (80387 only)
FTST	Compare value to zero, set flags
FXAM	Test type of value, set flags
TRANSCENDENTAL	
FPTAN, FPATAN	Tangent and arctangent (partial on 8087 and 80287; generalized on 80387)
FSIN, FCOS, FSINCOS	Sine and cosine (80387 only)
F2XM1	Raise 2 to power and subtract one
FYL2X	Multiply value times $\log_2$ of another value
FYL2XP1	Multiply value times $\log_2$ of another value plus one
CONSTANTS	
FLDZ	Load the value zero
FLD1	Load the value one
FLDPI	Load the value pi
FLDL2T	Load the value $\log_2(10)$
FLDL2E	Load the value $\log_2(e)$
FLDLG2	Load the value $\log_{10}(2)$
FLDLN2	Load the value $\log_e(2)$
PROCESSOR CONTROL	
FINIT	Initialize coprocessor
FSTSW	Store status word (FSTSW AX form not available on 8087)
FLDCW, FSTCW	Load or store control word
FCLEX	Clear coprocessor exception (error) flags
FLDENV, FSTENV	Load or store coprocessor environment
FSAVE, FRSTOR	Save or restore coprocessor state
FINCSTP, FDECSTP	Increment or decrement coprocessor stack pointer
FFREE	Mark floationg-point register as empty
FNOP	Coprocessor "no-operation"
FENI, FDISI	Enable or disable coprocessor error interrupts (8087 only; ignored on 80287 and 80387)

Figure 2: A summary of the instruction set of the 8087, 80287, and 80387 numeric coprocessors.

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Date of Residence: Month Year **Monthly Payment: $** ☐ Buy ☐ Rent ☐ Other

Previous Address: **Dates of Residence:** From To

Your Employer: (If self employed, see rear panel.) **Date of Employment:** Mo Yr **Position:** **Monthly Income:** Gross $ Net $

Employer's Address: Street City State **Business Phone:** ( ) –

Previous Employer: **Address:** **Dates of Employment:** From To

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Other Income:

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Include joint applicant's information, if joint account requested

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Bank Account:		☐ Checking ☐ Savings		
Bank Loan Reference:				
Bank Card Reference:	VISA / Mastercard			
Other Credit Card Reference				
Other Credit References:	Account No.	Expires		

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c. Joint Applicant's Personal Information

If you are a married Wisconsin applicant, you must provide your spouse's information below, even though your spouse may not be signing this contract

Joint Applicant's Name: First Initial Last **Date of Birth:** Mo Day Yr **Social Security Number:**

Address Street Apt # City State Zip **Date of Residence:** Mo Yr **Home Phone** ( ) –

Employer: **Date of Employment:** Mo Yr **Position:** **Monthly Income:** Gross $ Net $

Employer's Address: Street City State **Business Phone:** ( ) –

d. Self-Employed Information

Complete this section only if you are self employed

Business Name		Proprietorship Corporation Partnership	
Business Address			Business Telephone ( )
Description of Business	Your Position		In Business Since
Your annual income from business	Business annual income (gross)	(net)	
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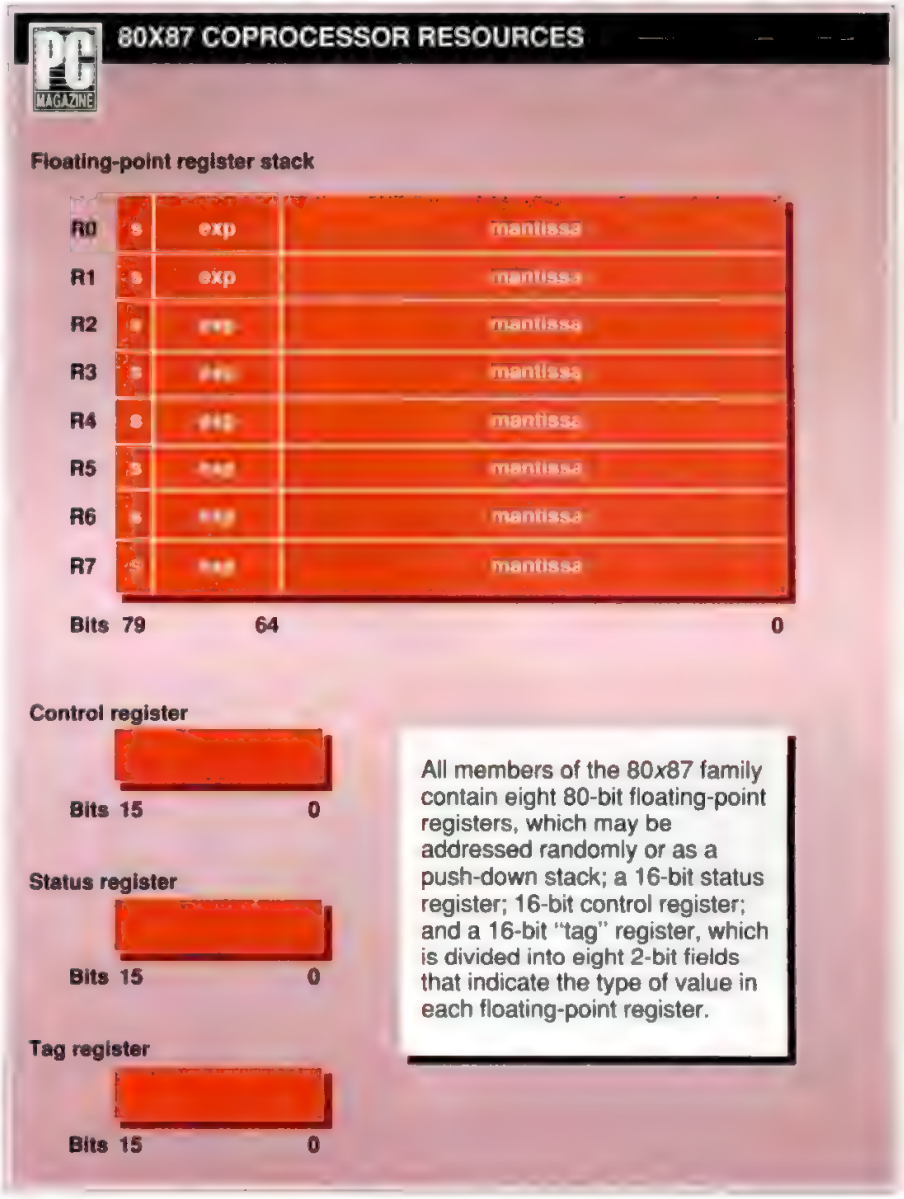

Figure 3: Special coprocessor instruction pointer and data pointer registers are also common resources of 80x87 chips. They're located on the CPU and used by floating-point error handlers.

ming requires careful scheduling of operations and counting of cycles so that both processors will be kept as busy as possible and will not waste time waiting on each other. The required coding is also extremely environment-dependent, since instruction timings vary widely among the different models of CPUs and numeric coprocessors.

The instructions understood by 80x87 coprocessors fall into six basic categories: data transfer, arithmetic, comparison, transcendental, constants, and processor control. These are summarized in Figure 2. Mnemonics ending with "P" automatically pop one operand off the coprocessor's floating-point register stack; mnemonics ending with "PP" pop two operands. The instruction sets of the 80287 and 80387 are proper supersets of the 8087; the 80287 and 80387 will run 8087 application code without modification. However, considerably better performance and more powerful programs can be obtained by modifying the source code to take advantage of the improved synchronization characteristics and instruction sets of the 80287 and 80387. The generalized

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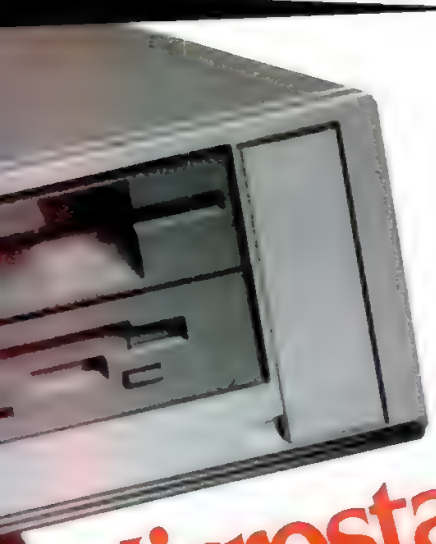

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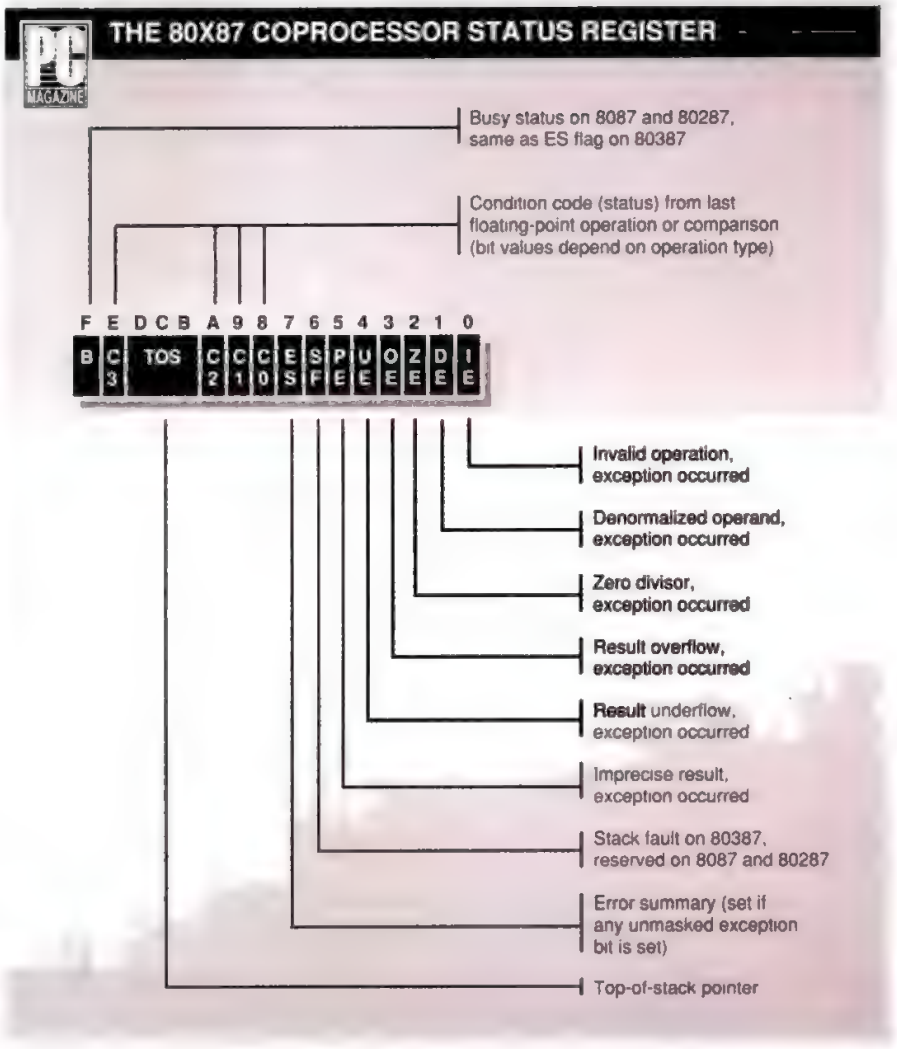

Figure 4: The read-only word in the coprocessor status register can be examined by programs to determine the result of the most recent floating-point operation or the cause of the most recent floating-point exception (error).

tangent, arctangent, sine, and cosine instructions, which are unique to the 80387, are particularly important in these respects.

As illustrated in Figure 3, the basic on-chip resources that are common to all members of the 80*x*87 family are eight floating-point registers, a tag word, a control word, and a status word. The floating-point registers are each 80 bits wide and are generally used as a push-down stack. (Each register can instead be addressed directly by the programmer when necessary.) The tag word is divided into eight 2-bit fields, each of which corresponds to a floating-point register. Each of these fields indicates whether the register is empty or whether the number in that register is valid or invalid, a floating-point value, zero, or infinity.

The status word, which is read-only, contains the condition codes for the most recent floating-point operation, error indicators, and also a specification of which floating-point register is the current top of stack. This is diagrammed in Figure 4. If you push too many numbers onto the 80*x*87 stack and the top-of-stack pointer wraps, an exception is generated. Similarly diagrammed in Figure 5, the control word is read/write and determines the rounding mode of the chip and the precision to which operations are carried out. "Mask" bits in the control word determine which types of errors are allowed to generate an interrupt.

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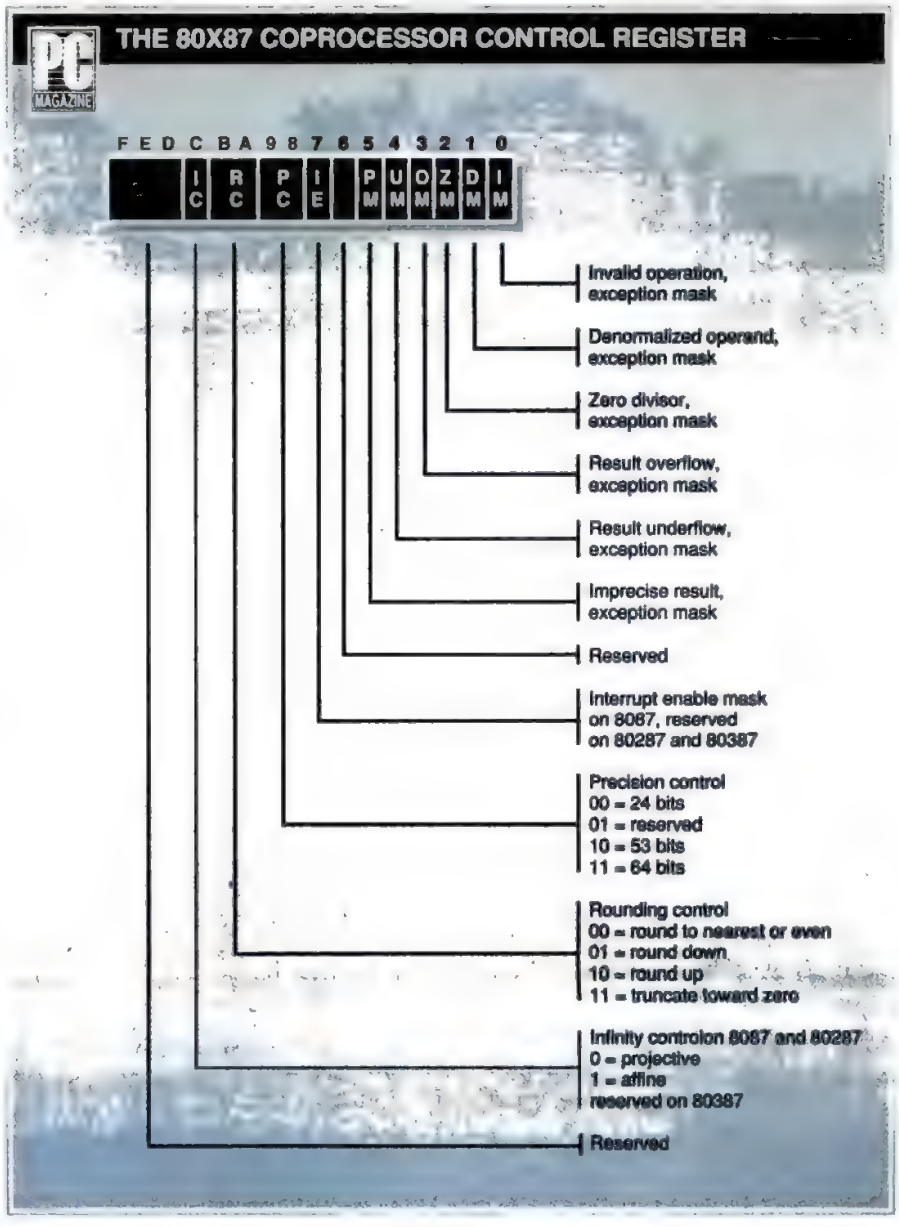

Figure 5: The word in the control register can be read or written by application programs to query or set the current rounding mode and precision mode and to control error handling. When the exception mask bit for a particular error type is set to 1, that error type will not generate an interrupt, and the value of the result will be set to a special bit pattern called a NaN (Not-a-Number).

In addition to the registers that are on board the coprocessor, there are special coprocessor instruction pointer and data pointer registers located on the CPU chip that are associated with the coprocessor's execution of floating-point instructions. When a coprocessor error interrupt occurs, the interrupt handler can examine these registers to determine the location and type of the floating-point instruction and/or operand that caused the problem. (Since the CPU and coprocessor generally run asynchronously, the values in the CPU's own instruction pointer and registers are not likely to be helpful.)

80x87 DATA FORMATS

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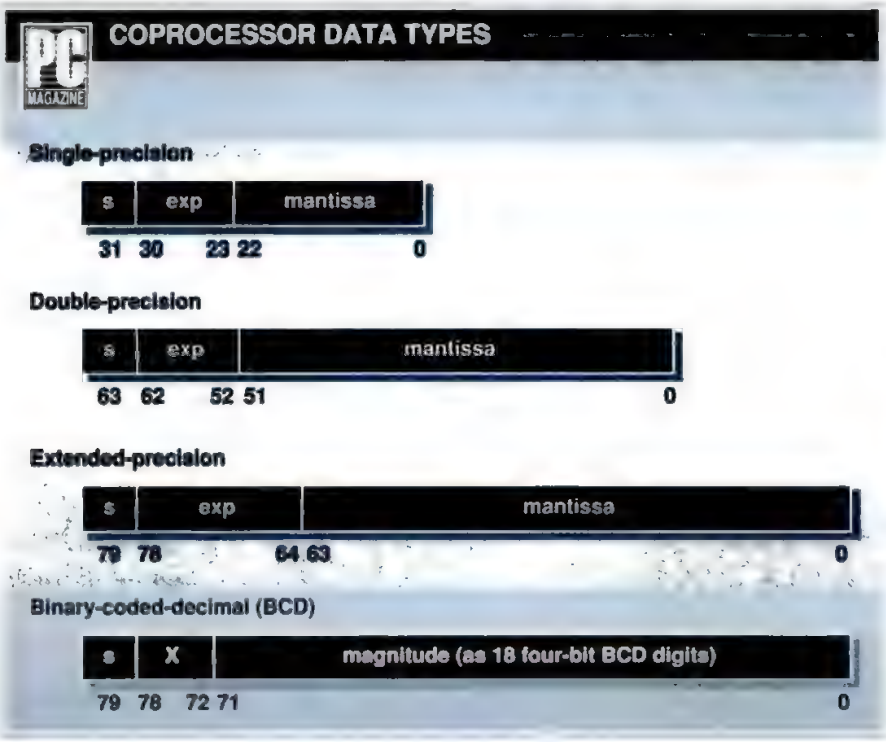

Figure 6: Floating-point and binary-coded-decimal data formats supported by the Intel 80x87 numeric coprocessor family in memory. The single-precision and double-precision floating-point formats are as specified in the ANSI/IEEE 754 standard. The binary-coded-decimal (BCD) format packs two digits per byte, giving a total of 18 digits plus a sign bit in an 80-bit format (*x* represents 7 bits that are unused). The 16-, 32-, and 64-bit integers (not shown here) are normal two's complement binary integers with the sign in the most significant bit. Regardless of a number's format in memory, when it is loaded into a floating-point register on the coprocessor, it is always converted into the extended (80-bit) floating-point format.

SPECIAL IEEE-STANDARD EXPONENT VALUES

Exponent bits	Mantissa bits	Special meaning
all zero	all zero	floating-point zero
all zero	nonzero	denormalized floating-point number (usually result of "graceful underflow")
all set	all zero	infinity
all set	nonzero	"Not a Number" or "NaN" (various reserved mantissa values are used to signal overflow, unrecoverable underflow, invalid operands, invalid result, inexact result, and so on)

Figure 7: Floating-point numbers in which all bits are zero or all bits are set in the exponent field are trapped and receive special treatment in accordance with the ANSI IEEE 754 binary floating-point standard.

to get that number to the coprocessor is to store it in RAM first. With but one exception there is no direct register-to-register communication between the CPU and the coprocessor. (The exception is that, on the 80287 and 80387, the FSTSW instruction is able to write the coprocessor's status word directly into the CPU's AX register. This expedites testing the results of a floating-point operation for conditional branching.)

The coprocessor family supports 7 different data types in memory: 16-, 32-, and 64-bit integers; 80-bit packed binary coded decimal (BCD); and 32-, 64-, and 80-bit floating-point numbers. These are shown in Figure 6. The 32-bit and 64-bit floating-point formats are identical to those defined by the ANSI/IEEE 754 Standard. The 16- and 32-bit integer formats are identical to those supported by the entire 80*x*86 family. And the 64-bit integer format is the same as the double-precision integers used by the 80386 machine when it is running in 32-bit protected mode. Regardless of a number's format in memory, however, when it is loaded into a coprocessor floating-point register it is always converted to the 80-bit "extended-precision" floating-point format (which is also called the "temporary real" data type in some Intel manuals).

Intel CPUs and coprocessors communicate primarily via shared memory rather than direct register-to-register. So to use a number in a CPU register in a calculation you must store it in RAM first.

The use of the extended-precision floating-point format for all operations that are internal to the 80*x*87 coprocessor family has some interesting consequences. First,

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INIT87.ASM — **COMPLETE LISTING**

```
        title   INIT87.ASM Initialize Numeric Coprocessor
        page    55,132

; INIT87.ASM    Initialize 80x87 Numeric Coprocessor
;
; Copyright (C) 1989 Ziff Davis Communications
; PC Magazine * Ray Duncan
;
; Call with:    AX      = control word for desired rounding
;                         mode, precision, exception mask
;
; Returns:      (if coprocessor present)
;               Z flag  = True (1)
;
;               (if coprocessor not found)
;               Z flag  = False (0)
;
; Destroys:     nothing

_TEXT   segment word public 'CODE'

        assume  cs:_TEXT

        public  init87
init87  proc    near

        push    bx                      ; save registers
        push    ax

        mov     ax,-1                   ; put FFFFH on stack
        push    ax
        mov     bx,sp                   ; make it addressable

        fninit                          ; try to initialize coprocessor
        fnstsw  ss:[bx]                 ; try to get status word

        pop     ax                      ; if low 8 bits are zero,
        or      al,al                   ; coprocessor is present

        jnz     initx                   ; jump if no coprocessor

        fldcw   ss:[bx+2]               ; load coprocessor control word

initx:  pop     ax                      ; restore registers
        pop     bx
        ret                             ; and return result in Z flag

init87  endp

_TEXT   ends

        end
```

Figure 8: This routine tests for the presence of an 80x87 numeric coprocessor and, if one is present, configures it for the desired rounding, precision, and error-handling modes.

since the dynamic range of the 80-bit format is so much greater than that of the 32-bit or 64-bit floating-point formats typically used in program variables, an overflow or underflow of a final result is quite rare, assuming that all intermediate results are maintained on the chip. Second, conversion of a number from one data type to another in memory is trivial: you just load the original data from memory onto the coprocessor, and then unload it again in the desired format.

Let's take a closer look at the coprocessor's extended floating-point data type, which corresponds to the optional double extended format of the ANSI/IEEE 754 Standard. (I discussed the single-precision and double-precision floating-point number formats here last time.) The dynamic range of these numbers is approximately $\pm 3.4*10^{-4932}$ to $\pm 1.2*10^{4932}$. The 80 bits are divided into three fields: a sign bit, a 15-bit exponent (sometimes called a "characteristic"), and a 64-bit mantissa (or "significand").

The sign bit is 1 if the number is negative and 0 if the number is positive. The mantissa is unsigned and does not change with the sign of the floating-point number. Because the mantissa is left-normalized, its most significant bit is always 1 unless the number is zero or unless it is the result

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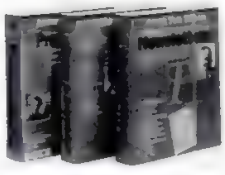

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CIRCLE 322 ON READER SERVICE CARD

DIMUL87.ASM — **COMPLETE LISTING**

```
        title   DIMUL87.ASM 80x87-based Signed Divide
        page    55,132

; DIMUL87.ASM   Double Precision Signed Integer Multiply
;               for 80x87 coprocessor and 8086, 8088, 80286, or
;               80386 in real mode/16-bit protected mode
;
;               Be sure to call INIT87 routine first to test for
;               coprocessor existence and to set rounding mode,
;               precision, and exception masks!
;
; Copyright (C) 1989 Ziff Davis Communications
; PC Magazine * Ray Duncan
;
; Call with:    DX:AX           = double-precision argument 1
;               CX:BX           = double-precision argument 2
;
; Returns:      DX:CX:BX:AX     = quad-precision product
;
; Destroys:     nothing

_TEXT   segment word public 'CODE'

        assume  cs:_TEXT

        public  dimul
dimul   proc    near

        push    dx                      ; put argument 1 on stack
        push    ax

        push    cx                      ; put argument 2 on stack
        push    bx

        mov     bx,sp                   ; make arguments addressable

        fild    dword ptr ss:[bx]       ; load one argument
        fimul   dword ptr ss:[bx+4]     ; multiply it by the other

        fistp   qword ptr ss:[bx]       ; unload the result
        fwait                           ; wait for it to arrive

        pop     ax                      ; retrieve result
        pop     bx
        pop     cx
        pop     dx
        ret                             ; and exit

dimul   endp

_TEXT   ends

        end
```

Figure 9: This performs signed integer double-precision multiplication using the coprocessor.

of an operation that underflowed or had invalid operands. Unlike the single-precision and double-precision floating-point data formats, no implied leading bit is used in the mantissa of the extended-precision format.

The exponent is "biased"—offset from zero—by the value 16,383 (3FFFH). For example, a value of 16,386 in the exponent fields corresponds to an exponent of 3—in other words, the mantissa is multiplied by 2^3. Use of a biased exponent ensures that the reciprocal of any normalized floating-point number can be represented without underflow. The exponent can also take on two "magic" values that cause the number to be handled in a special way. If all bits of the exponent are zero, then the number is either zero or is a "denormalized" number—the result of a "graceful underflow." If all bits of the exponent are set, then the floating-point number represents either infinity or a special signalling value called a NaN (Not-a-Number). These combinations and their meanings are shown in Figure 7.

ELEMENTARY COPROCESSOR USAGE

Before an application program can make use of a coprocessor, it must first verify the coprocessor's presence in the host machine and then configure it for the desired

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DIDIV87.ASM — COMPLETE LISTING

```
        title   DIDIV87.ASM 80x87-based Signed Divide
        page    55,132

; DIDIV87.ASM   Double Precision Signed Integer Divide
;               for 80x87 coprocessor and 8086, 8088, 80286, or
;               80386 in real mode/16-bit protected mode
;
;               Be sure to call INIT87 routine first to test for
;               coprocessor existence and to set rounding mode,
;               precision, and exception masks!
;
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;
; Call with:    DX:CX:BX:AX     = quad-precision dividend
;               SI:DI           = double-precision divisor
;
; Returns:      DX:AX           = double-precision quotient
;               CX:BX           = double-precision remainder
;
; Destroys:     nothing

_TEXT   segment word public 'CODE'

        assume  cs:_TEXT

        public  didiv
didiv   proc    near

        push    dx                      ; put dividend on stack
        push    cx
        push    bx
        push    ax

        push    si                      ; put divisor on stack
        push    di

        mov     bx,sp                   ; make arguments addressable

        fild    dword ptr ss:[bx]       ; put divisor on coprocessor
        fild    qword ptr ss:[bx+4]     ; put dividend on coprocessor

        fld     st(1)                   ; make copies of both
        fld     st(1)

        fdivrp  st(1),st(0)             ; perform signed divide

        fistp   dword ptr ss:[bx]       ; unload quotient

        fprem                           ; calculate remainder

        fistp   dword ptr ss:[bx+4]     ; unload remainder
        fstp    st(0)                   ; discard stack top

        pop     ax                      ; quotient into DX:AX
        pop     dx

        pop     bx                      ; remainder into CX:BX
        pop     cx

        add     sp,4                    ; clean up stack
        ret                             ; and exit

didiv   endp

_TEXT   ends

        end
```

Figure 10: This performs signed integer double-precision division with the numeric coprocessor.

rounding, precision, and error handling modes. One method of doing this is illustrated by the procedure INIT87.ASM, shown in Figure 8. The routine will first execute a no-wait form of the coprocessor initialization instruction FINIT, then it will attempt to transfer the status word from the coprocessor into a memory word that has been initialized to FFFFH with the FSTSW instruction. If the coprocessor is present, the procedure sets the desired modes by loading the coprocessor control word and then returns a status code in the CPU's zero flag.

The DIMUL87.ASM and DIDIV87.ASM routines, which are listed in Figures 9 and 10, illustrate some basic principles of coprocessor programming. They use the coprocessor to implement double-precision integer (32-bit) signed multiplication and division, and are thus symmetric with the software-only unsigned multiply and divide routines DMUL.ASM and DDIV.ASM, published here in our November 14, 1989, issue. Note that the coprocessor does not directly support unsigned integer multiplies or divides, so I couldn't code direct equivalents for the previous DMUL.ASM and DDIV.ASM routines without going to a great deal of trouble to handle the upper half of the unsigned range.

Before an application program can make use of a coprocessor, it must first verify its presence in the host machine.

The interactive demo programs TRYDIMUL and TRYDIDIV illustrate the use of INIT87, DIMUL87, and DIDIV87. They test the status of the coprocessor, prompt you for two arguments, carry out the multiplication or division operation on the coprocessor, and then display the results. The source code for these two demo programs can be downloaded from PC MagNet.

In the next issue, we'll proceed to a discussion of coprocessor floating-point operations, proper use of the WAIT (FWAIT) instruction on the various coprocessor models, use of the various coprocessor rounding modes, and error handling.

THE IN-BOX

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by
Neil J. Rubenking

User-to-User

A QUICK CHECK FOR VIRUS ACTIVITY

Since there has been a recent surge in computer viruses, I decided to try to monitor my system more carefully. My first step was to add the lines shown in Figure 1 to my AUTOEXEC.BAT file.

Because some viruses attach themselves to COMMAND.COM first and then spread to other disks, adding these lines lets you compare COMMAND.COM's actual size with the size it should be. And if you reboot daily, you can check COMMAND.COM's size on a regular basis.

Before you put these lines in your AUTOEXEC.BAT file, make sure that your COMMAND.COM file is virus-free. And whenever you make any changes to COMMAND.COM that affect its size, remember to update the appropriate line in your AUTOEXEC file.

Thomas C. Nelson
Bedford, New York

PC MAGAZINE There has been more of a "surge" in virus publicity than in actual viruses. Still, COMMAND.COM is a prime target, and it doesn't take much time or effort to check it on a regular basis. Note that though some viruses change the size of the file and some change the date, others manage their dirty deeds without changing either. So you shouldn't use this test as a replacement for a true antivirus program.

The batch lines in Figure 1 require you to look at the screen to notice any problem. Well, computers are supposed to handle this kind of chore *for* us. Figure 2 shows CHECKCOM.BAT, which performs the test automatically. You'll have to replace 25307 and 3-17-87 with the appropriate size and date for your own COMMAND.COM, of course.

The test for a match depends on the fact that DOS won't copy a zero-length file. If the FIND command doesn't find the correct size or date, the file TEMP$$$1 will have zero length. The copy command will not create TEMP$$$2, and the IF EXIST TEMP$$$2 test will fail. There are other ways to branch based on the result of a FIND, but they tend to require multiple batch files.

- **A QUICK CHECK FOR VIRUS ACTIVITY:** Use this simple method as a first defense against viruses.
- **USING ANSI.SYS TO REDEFINE KEYS:** Here's some additional information to make ANSI key redefinitions easier.
- **NO PURCHASE NECESSARY:** An alternative to buying a commercial phone dialer.
- **SIMPLIFYING SOFTWARE ACCESS:** Ditch that mile-long PATH—use batch files.

USING ANSI.SYS TO REDEFINE KEYS

In the October 17, 1989 issue of *PC Magazine*, User-to-User described some useful ANSI key redefinitions using the PROMPT command. Many readers didn't realize that to use these commands in a batch file, you have to put them before the ECHO OFF command. ANSI strings take

VIRUS CHECK

```
ECHO OFF
CLS
C:
CD\
ECHO COMMAND.COM SHOULD BE
ECHO 25307 BYTES.
ECHO IF IT ISN'T, YOU MAY
ECHO NEED A FLU SHOT FOR A
ECHO COMPUTER VIRUS
DIR COMMAND.COM
PAUSE
```

Figure 1: Append these batch lines to your AUTOEXEC.BAT file to regularly check the size of COMMAND.COM.

CHECKCOM.BAT — **COMPLETE LISTING**

```
ECHO OFF
DIR C:\COMMAND.COM | FIND "25307" > TEMP$$$1
COPY TEMP$$$1 TEMP$$$2 > NUL
IF EXIST TEMP$$$2 GOTO OK1
ECHO COMMAND.COM is the wrong size. Time to worry.
GOTO finish1
:OK1
DEL TEMP$$$2
ECHO COMMAND.COM is the right size.  You can relax.
:finish1
DEL TEMP$$$1
DIR C:\COMMAND.COM | FIND "3-17-87" > TEMP$$$1
COPY TEMP$$$1 TEMP$$$2 > NUL
IF EXIST TEMP$$$2 GOTO OK2
ECHO COMMAND.COM's date has been changed.  Time to worry.
GOTO finish2
:OK2
DEL TEMP$$$2
ECHO COMMAND.COM has the right date.  You can relax.
:finish2
DEL TEMP$$$1
```

Figure 2: CHECKCOM.BAT automatically checks COMMAND.COM against known values for size and date and warns you if either has changed.

effect at the time they're written to the screen, and when ECHO is OFF, the prompt doesn't appear at all.

In addition, gremlins wrecked two of the redefinition lines by replacing the dollar sign with a percent sign. The correct commands to swap the colon and semicolon keys are

```
PROMPT $E[58;59P
PROMPT $e[59;58p
```

Again, for these commands to be effective in a batch file, they must appear before the ECHO OFF statement.

NO PURCHASE NECESSARY

Recently, while thumbing through a back issue of *PC Magazine* (June 23, 1987), I came across an item in the User-to-User column that described a batch file appointment scheduler. This short utility inspired me to write a batch file address book and phone dialer that works with a Hayes-compatible modem.

The program consists of four separate files:

- BB.BAT (a short "front-end" file);
- ATDT.BAT (does most of the work);
- XB.BAT (removes names from a list); and
- BB.LST (contains the name, address, phone number list). Entries into BB.LST can be anywhere from two to nine words in length.

These files are shown in Figures 3 through 6, respectively.

To use these programs,

- Type BB ? for help;
- Type BB for a list of numbers and addresses;
- Type BB 9-999-999-9999 LAST FIRST ST CITY STATE ZIP to add names;
- Type BB (character string) to find a name and dial the number;
- Type XB (character string) to delete a name and number. The character string must be a single unique word; otherwise you will delete or find more than one entry.

Since the DOS FIND.EXE program is case sensitive, I suggest that you capitalize all entries. The program dials the requisite number simply by ECHOing the Hayes dial command, ATDT, and a phone number to the modem port (COM1 in my case). The most important batch file, which is called ATDT.BAT, serves to initialize the replaceable parameter %0 to ATDT whenever this file is called by BB.BAT.

Once initialized, the %0 parameter can be used to insert the modem dial command in front of the phone number.

The only problem I have had with the program is that the DOS FIND.EXE program adds a blank line to BB.LST whenever a name is deleted.

The possibilities that are available using the handful of functions in the DOS batch language continue to amaze me.

Ernie Deel
Decatur, Alabama

BB.BAT

```
@ECHO OFF
ATDT %1 %2 %3 %4 %5 %6 %7 %8 %9
```

Figure 3: BB.BAT does nothing but call ATDT.BAT, which does all the work.

ATDT.BAT COMPLETE LISTING

```
@ECHO OFF
IF "%1"=="?" GOTO FIRSTIME
IF %1!==! GOTO LIST
IF %2!==! GOTO SEARCH
IF EXIST NUMBER.BAT GOTO DIAL
ECHO %0 %1 %2 %3 %4 %5 %6 %7 %8 %9 >UP.DAT
COPY C:\PHONE\BB.LST+UP.DAT C:\PHONE\BB.LST >NUL
DEL UP.DAT
ECHO .
ECHO (%1 %2 %3 %4 %5 %6 %7 %8 %9 --ADDED)
ECHO .
GOTO DONE
:FIRSTIME
CLS
ECHO --------------------[ B L A C K   B O O K   H E L P ]----------------
ECHO .
ECHO ENTER NEW NUMBERS   : BB 9-999-999-9999 Last, First Street City St zip
ECHO FIND\DIAL NUMBERS   : BB (Any character string)
ECHO  DELETE   NUMBERS   : XB (Any character string)
ECHO   LIST    NUMBERS   : BB
ECHO .
ECHO ------------------------------------------------------------------------
GOTO DONE
:LIST
IF NOT EXIST C:\PHONE\BB.LST GOTO FIRSTIME
CLS
ECHO -------------------------[ B L A C K   B O O K ]----------------------
TYPE C:\PHONE\BB.LST | MORE
ECHO .
ECHO ------------------------------------------------------------------------
GOTO DONE
:SEARCH
CLS
IF NOT EXIST C:\PHONE\BB.LST GOTO FIRSTIME
FIND "%1" C:\PHONE\BB.LST | FIND /V "BB">NUMBER.BAT
ECHO -------------------------[ B L A C K   B O O K ]----------------------
TYPE NUMBER.BAT
ECHO .
ECHO ------------------- TYPE CONTROL-C TO ABORT DIALING ------------------
ECHO .
ECHO To Dial %1, Pick up the phone and
PAUSE
NUMBER
:DIAL
CLS
ECHO %0%1,,,,Z>COM1
CLS
ECHO .
ECHO ------- DIALING %1 -------
ECHO .
ECHO Once the modem makes the connection, press
ECHO any key to hang it up and connect the phone.
PAUSE >NUL
ECHO ATZ>COM1
:DONE
ECHO .
IF EXIST NUMBER.BAT DEL NUMBER.BAT
```

Figure 4: ATDT.BAT actually does the work for BB.BAT.

If you compare this solution with a modern phonebook program such as *Hot Line*, this collection of batch files is S-L-O-W. However, commercial phone programs cost money, and this one costs nothing but your time to type it in.

This set of batch files assumes your phone list is C:\PHONE\BB.LST. If you want to give the list another name or store it in another directory, be sure to fix ATDT.BAT and XB.BAT. Note also that you *may* have to initialize your COM port with the MODE command before using the Black Book files. The command

```
MODE COM1:12,n,8,1
```

would set up COM1 for 1,200-bit-per-second communications with 8 data bits, 1 stop bit, and no parity.

This letter mentions a problem with adding a blank line to the BB.LST when deleting a name. This is part of the function of FIND.EXE—it can operate on multiple files, and it inserts a line in the output to define the current file. XB.BAT filters out the inserted line, but it can't filter out the blank line that follows. But it's easy to sidetrack this feature. Just TYPE the file and pipe the result to FIND, and the problem will be gone. For example,

```
TYPE C:\PHONE\BB.LST | FIND /V "%1"
 > C:\PHONE\UP.DAT
```

Do note that you cannot use multiple words in your character search strings, either for dialing or for deleting. I added a test to XB.BAT that warns you if you try to use multiple words. But if you try something like BB JOHN SMITH, you won't dial Mr. Smith. Instead, you'll get the line ATDT JOHN SMITH added to your phone book.

SIMPLIFYING SOFTWARE ACCESS

The most efficient way to organize your hard disk is to create a system of directories and subdirectories. Such systems make disk management a great deal easier but are often irritating for users—like me—who must then navigate through a maze of subdirectories in order to run a specific software package. User access to these applications can be simplified by developing a series of batch files and storing them in a single directory that's on the PATH set in the AUTOEXEC file.

In my AUTOEXEC.BAT, I specify the path directory for my hard disk with the command PATH C:\DOS. For each application I use, I've created a short batch file stored in the C:\DOS directory that changes to the directory housing the application program and executes the files needed to enter the application.

I have given each of these batch files a short name signifying the application that it accesses; for example, SC.BAT for *SuperCalc4*, WP.BAT for *WordPerfect*, and DB3.BAT for *DBASE III*.

Since C:\DOS is my path directory, I can invoke these batch files from anywhere on my hard disk. I no longer need to concern myself with the directory structure of my hard disk when I want to run an application. All I have to do is to remember the batch file names and I'm on my way!

Ross F. McGurn
Reading, Massachusetts

A single-directory PATH is unusually short, but it's definitely a bad idea to make your PATH longer than necessary. If you mistype a program name, DOS has to search every directory on the PATH before it can return with "Bad command or file name."

Like Mr. McGurn, I activate particular applications using batch files stored on the PATH. My DOS directory contains only DOS files, so my path looks like this:

```
D:\DOS;D:\UTILS;D:\BAT
```

The UTILS directory contains utilities that need to be available at all times, and the BAT directory contains batch files.

If a particular program *needs* to be on the PATH while running, you can add it temporarily in the batch file that activates it. Just store the existing PATH in an environment variable, add the new directory to the PATH, run the program, and restore the original PATH, as follows:

```
SET OLDPATH=%PATH%
PATH C:\MYDIR;%PATH%
MYPROG
PATH %OLDPATH%
SET OLDPATH=
```

This will do the job *without* permanently inflating your PATH.

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XB.BAT — COMPLETE LISTING

```
@ECHO OFF
IF %1!==! GOTO OOPS
IF NOT %2!==! GOTO TOOMANY
FIND /V "%1" C:C:\PHONE\BB.LST | FIND /V "BB" > C:\PHONE\UP.DAT
REM TYPE C:\PHONE\BB.LST | FIND /V "%1" > C:\PHONE\UP.DAT
DEL C:\PHONE\BB.LST
REN C:\PHONE\UP.DAT BB.LST
GOTO END
:TOOMANY
ECHO .
ECHO Sorry, you cannot have spaces in your XB character string.
:OOPS
ECHO .
ECHO To DELETE names from the BLACK BOOK, type: XB (Any character string).
ECHO .
:END
```

Figure 5: This batch file deletes files from BB.LST.

A TYPICAL BB.LST FILE

```
ATDT 000-0000 JOHN Q PUBLIC 123 PLEASANT STREET ANYTOWN USA
ATDT 000-0000 JANE DOE BOX 12345 SMALLVILLE
```

Figure 6: A sample phone list from the file BB.LST.

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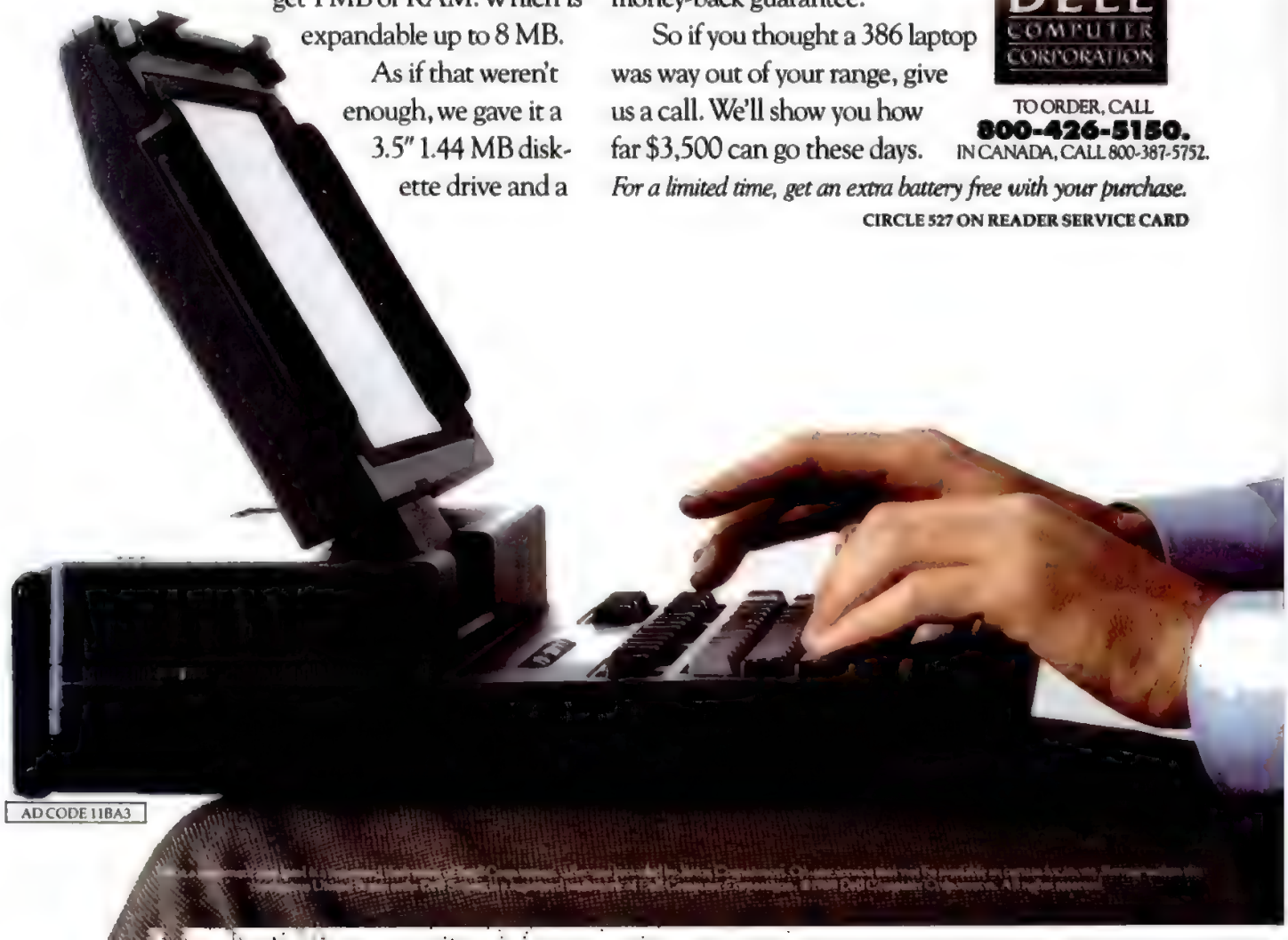

AD CODE 11BA3

edited by
Craig L. Stark

Power User

CLEARING WINDOWS

When you want to clear a document from the screen and start another in *Microsoft Word*, the Window Close command works far faster than the Transfer Clear All command. For maximum convenience, create the macro

```
<esc>wc<enter>
```

and save it as a function-key macro or a control-key sequence such as <Ctrl Q>C for Quick Clear.

Thomas A. Pallen
Clarksville, Tennessee

PC MAGAZINE Sometimes the simplest time-savers are the easiest to overlook. As pointed out, the Transfer Clear All command takes far longer to clear a window than the Window Close command. On an XT, with one window open, I clocked the Transfer Clear All command at a frustrating 18 seconds, compared with about 2 seconds for the Window Close command. Even on a 12-MHz AT clone, the Transfer Clear All command took 6.6 seconds, compared with less than 1 second for Window Close.

Be aware that there are differences in what each of these commands does, however: Transfer Clear All clears everything—windows, scrap, glossary, and style sheets—and erases all .TMP files, so that it effectively restarts *Word*. Part of the reason it takes so long to execute is that it then has to reload the glossary and stylesheets. The Window Close command affects only the text in the current window. Obviously, if you want to close several windows with a single command or otherwise start from scratch, Transfer Clear All is the preferred choice.

Also note that the Transfer Clear Window command is just as fast as the Window Close command. If you have only one window open, there is little difference between these commands. If you have multiple windows open, however, the Transfer Clear Window command will let you clear a window without closing it. If you're planning to load another file, this saves you the step of having to reopen the window.—*M. David Stone*

- CLEARING WINDOWS: Here's a quick way to close windows in Word.
- BEEFING UP SECURITY: You can encrypt your dBASE files with this short DEBUG script.
- CREATING NUMBERED PARAGRAPHS: A few approaches to creating numbered paragraphs in Microsoft Word.
- TURN FOOTNOTES INTO ENDNOTES: How to make a WordPerfect limitation work to your advantage.

BEEFING UP SECURITY

Here's a useful security lock to prevent access to *dBASE III* and *IV* files on single-user computers that is actually part of *dBASE*'s networking system.

By writing an 'X' to the 15th byte of a *dBASE* file header, any subsequent attempt to USE the file in *dBASE* will return the error message "Database encrypted." To change this byte in the file header, use this DEBUG script, ENCRYPT.SCR:

```
A 10F
DB 'X'

W
Q
```

Be sure to create it using a pure ASCII text editor and end each line with a carriage return (including the blank line in the middle and the final Q line). Also, make sure DEBUG.COM is on your DOS path. Then from the DOS prompt, enter

```
DEBUG filename.dbf < encrypt.scr
```

where *filename* is the name of the file that you want encrypted.

Kevin Owens
Kennesaw, Georgia

PC MAGAZINE This is more of a fence than a lock because both *FoxBASE* and *Clipper* could still access this .DBF file. Still, this could be very useful where a *Clipper* application is installed and you don't want people accessing with the data interactively in *dBASE*.

To reverse the process and unencrypt your file, make a second DEBUG script that is the same as the first script except that the second line (DB 'X') should be changed to

```
DB 00
```

When the DOS command

```
DEBUG filename.dbf < uncrypt.scr
```

is issued, the 15th byte will be replaced with a null character.—*Brad Stark*

CREATING NUMBERED PARAGRAPHS

There is an easier way to create numbered paragraphs in *Microsoft Word* than the one in the September 27, 1988, issue. Create a paragraph numbered 1 that is formatted appropriately but has no text in it. Next, select the paragraph with F10, delete the paragraph to the scrap, and tap the Ins key once for each of the numbered paragraphs you want. Then, select all of the paragraphs (use F6 to extend the highlight, F10 to select each paragraph) and use the Escape Library Number Update command to auto-

matically number the paragraphs. Finally, enter the text as appropriate.

Ronny Richardson
Chamblee, Georgia

Several readers wrote in to suggest other ways to create numbered lists in *Microsoft Word*. (Mr. Richardson's had the earliest date.)

The point of Mr. Pandolfo's letter was to show how to create recursive macros for *Microsoft Word* by using *SuperKey*. The particular task of creating an outdented, numbered list was chosen (as far as I can tell) to keep the discussion simple. My response—showing how to use the repeat command from within *Word*—was certainly in that spirit. Nevertheless, the suggestions are not far off the mark.

Word provides two approaches to automatic numbering, depending on whether you call up the Library Number command from document view or outline view. Consider numbering in document view first.

In document view, *Word* will only number paragraphs that already start with numbers. Mr. Richardson's suggestion—to start by creating a numbered paragraph without text, and then copy it as many times as needed—will automatically put a number in each paragraph. Though it leaves you with the clumsy job of entering text in each without disturbing the numbers that are already there, it is certainly easier to use a repeating macro.

In answering Mr. Pandolfo's letter, I suggested a macro that would pause to let you enter the correct number for each item, then automatically enter a tab, and pause again to let you enter the text for the item. To use the macro with the automatic numbering feature, simply modify the macro to type the number 1 with each entry. The macro then becomes

```
«Ask howmany=?How many items will be
in this list»
«repeat howmany»1.<tab>«pause»
<enter>«endrepeat»
```

After you are finished, you can highlight the entire list and give the Escape Library Number Update command to correctly renumber the list.

Not so incidentally, note that for *Word* to recognize a character as a number, it must have either a period or closing parenthesis after it, followed by a tab or space. It can optionally have a closing parenthesis.

As for format—if you format the first paragraph before invoking the macro, you can essentially carry the format with you through the list. Or, you can create the list without worrying about the format. Then highlight the entire list and format it all at once, using either a stylesheet or the Escape Format Paragraph command.

If you perfer to use *Word*'s outline view for automatic renumbering, you don't have to enter a number for each paragraph. However, you can only number paragraphs that are designated as level headings. Start by going to outline view with <Shift F2>, and then designating a heading level for the current paragraph using <Alt 9> to move down a level or <Alt 0> to move up a level. Then type your list. As with format commands, the heading level will carry through to the next paragraph each time you type a carriage return.

When you're finished typing the list, go to the first item and enter a number in the format you want to use. Then, while still in outline view, give the Escape Library Number Update command, and *Word* will number the list.

As with automatic numbering from document view, you can either format the first paragraph before starting the list, or you can go back to document view after the paragraphs are numbered, highlight the list, and format it all at once.—*M. David Stone*

ENDNOTE MACRO — **COMPLETE LISTING**

```
<Ctrl-F10>                    begin macro definition
FOOTEND<CR>                   name it
Foot to Endnotes<CR>          describe it
<Home><Home><Home><Up>        to very top of document
<Alt-F7>4                     define columns
<F7>                          accept defaults
3                             turn columns on
<Home><Home><Down>            to bottom of document (force
                               reformat)
<Home><Home><Home><Up>        to very top again
<Del>Y                        delete the column definition
<Ctrl-F10>                    end macro definition
```

Figure 1: A quick and easy way to convert footnotes into endnotes by temporarily putting the document into newspaper columns. This macro will do the job in *WordPerfect*, Version 5.0.

TURN FOOTNOTES INTO ENDNOTES

Versions 4.2 and 5.0 of *Wordperfect* do not allow footnotes in columns. However, this "limitation" can be a quick and easy way to convert footnotes to endnotes. This is done by temporarily putting the document into newspaper columns. The macro shown in Figure 1 will do the job in Version 5.0.

If you run this macro with a footnoted document on the screen, it will force all footnotes to endnotes. If you delete the column-definition code, it deletes the orphaned <Column On> code as well.

To use this macro with *WordPerfect*, Version 4.2, you need only change the line labeled accept defaults from <F7> to

```
<CR><CR>2<CR><F7>
```

This process is *not* reversible, and the movement of footnote text to the end of the document will result in different page breaks. It is a good idea to keep a copy of the original file just in case you change your mind.

James L. Wright, Jr.
Provo, Utah

The success of this macro depends on *WordPerfect* forbidding footnotes in columnar text. Only endnotes are permitted, so *WordPerfect* changes footnotes to endnotes. If a future version of *WordPerfect* allows footnotes in columnar text, this tip won't work any more. But by then, perhaps there will also be a built-in command to change footnotes to endnotes and back.—*Neil J. Rubenking*

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by
Jeff Prosise

Tutor

A NEW TUTOR HEADS THE CLASS

Several years ago, Charles Petzold provided some mighty big shoes to fill when he stepped into the role of Tutor. Petzold set a high standard for this column in its early days, with his clear insight into technical matters and his ability to explain complicated issues in terms everyone could understand. Robert Hummel followed suit with his expertise in operating systems, hardware, and software. Hummel left no stone unturned in the search for answers to questions submitted by our readers.

Most recently, our senior technical editor, Tony Rizzo, took over the column, and somehow managed to wheedle some contributions out of me. Between us, we continued the tradition by shedding light on a variety of subjects ranging from RISC processors to the intricacies and inner workings of DOS. Before I knew it, I was hooked! When Rizzo offered the bait of taking over Tutor on a full-time basis, it didn't take me long to respond with an emphatic yes.

It is with the Tutor Tradition in mind that I take over the column. The goal: to tackle the technical questions—aimed at end users and programmers alike—that you have about your PCs, DOS, and OS/2. No question is too tough, nor are any too trivial. Whether you want to know what Virtual-86 mode and 386 memory managers do for real-mode programs running on the 386 (a subject we explore this issue), or simply why your hard disk isn't working the way it should, we will provide the answers. We'll continue to select the best questions and attempt to answer as many as we can in each issue, and at the same time try to further your PC education by explaining not just how, but why. With that said, let's get going!

- A NEW TUTOR HEADS THE CLASS: The tradition continues.
- PS/2 EXTENDED MEMORY: Yes, you can put that extra memory to good use.
- TIMING CRITICAL EVENTS: Here's a way to gain greater timer resolution.

PS/2 EXTENDED MEMORY

I have an IBM PS/2 Model 80 with 4MB of RAM. Some of the DOS applications I run on a regular basis use expanded, but not extended, memory, so even with 4MB of RAM on board, I'm still limited to a paltry 640K. Is there anything I can do to transform some of this extended memory into expanded memory and make use of all this additional RAM?

David W. Inouye
Boulder, Colorado

There sure is. One way is by using the EMS40.SYS device driver featured in *PC Magazine*'s June 27, 1989, Utilities column. EMS40.SYS is a background memory manager that transforms extended memory into LIM 4.0–compatible expanded memory and allows programs that use expanded memory to run without knowing that they're really running in extended memory. It runs on both 286 and 386 machines.

If you prefer to go with a commercial alternative, two top-notch utilities available are *386-to-the-Max* from Qualitas and *QEMM-386* from Quarterdeck Office Systems. They both allow extended memory to stand in for LIM 4.0 expanded memory on 386-based systems. With these programs, you can configure RAM beyond 1MB as extended or expanded, or as a combination of both. Or you can run in AUTO mode, where simple ON/OFF commands toggle back and forth between extended and expanded memory. It's clean, it's simple, and best of all, it lets you make as much practical use of the extra RAM on your computer as DOS allows.

Another benefit you gain from running *386-to-the-Max* or *QEMM-386* is that both take advantage of special 386 features to make more memory available to DOS. Not only can you load device drivers and TSRs into unused portions of memory located between 640K and 1MB, you can also gain more contiguous memory in which to run DOS application programs. The secret: the 386's Virtual-86 mode, which is similar to real mode except that it provides real-mode programs with access to a 4GB virtual address space through a process known as "paging."

Virtual-86 mode was added to the 386 in answer to the needs of millions of DOS users who wanted to multitask real-mode DOS applications without having to rewrite them. With the 8088 and 8086, it couldn't be done; real multitasking requires hardware-supported virtual memory management strategies, which prevent two concurrent processes from overwriting each other. The 286's protected mode has what it takes to isolate programs from one another, but while real-mode programs can't run in protected mode on either the 286 or the 386, they run without modification in Virtual-86 mode. Individual DOS programs running in separate Virtual-86 mode sessions believe that they own the machine and all of its resources (as they do in real-mode under DOS). In actuality, they own only the *virtual* machine they're running on—and virtual machines are physically isolated from one another by the 386 hardware.

But it's not the 386's ability to isolate tasks from one another that's important to supervisory programs such as *386-to-the-Max* and *QEMM-386;* it's the fact that Virtual-86 mode programs enjoy the same access to the 386's paging capabilities that protected mode programs do. Paging is a virtual memory management technique that allows fixed-size blocks of memory 4K in length—pages—to be mapped to any physical address in memory. On the 386, pages are aligned on even 4K bound-

aries and they are counted from the bottom of memory: page 0 is located at offset 0, page 1 is 4K above that at offset 1000H, and so on.

In real mode, the contents of 16-bit segment registers are multiplied by 16 and combined with 16-bit offsets to form 20-bit physical addresses. The same thing happens in Virtual-86 mode, but there is an added level of indirection. Rather than interpreting the resulting linear address as a physical address, the 386 consults a page lookup table if bit 31 (the PG bit) of register CR0 is set. The linear address is translated into a physical address that can lie anywhere in Virtual-86 mode's 4GB address space. As a result, unused RAM locations below 1MB can be backfilled with memory that actually lies outside DOS's normal 1MB address space.

The concept behind paging is simple. If you wanted to map the 4K page located at absolute address A0000H (the top of DOS's 640K address space) to a page in extended memory located at 120000H (128K above the 1MB barrier), you would place the decimal number 288 (signifiying that this, the 160th page in memory, is to be mapped to the 288th page) in the upper 20 bits of the 160th page table entry. When a program attempted to access a memory location in the 4K page that starts at A0000H, the 386 would magically transfer the access to the same offset in the page starting at 120000H—even if there were no RAM physically installed at A0000H.

The lower 12 bits of each page table entry are used for other purposes. Bit 0, for example, called the "present bit," is set when the associated page is present in memory and cleared when it has been swapped out to disk. Bit 6, the "dirty bit," is set by the CPU when a write occurs within the page. Bit 5 is set when any type of memory access—a read or a write—occurs within the page. And bits 1 and 2 are used by the 386's page protection mechanism. All other bits are either reserved or available for use by systems programmers.

Since the 386 provides programs with access to over 4GB of memory and one page is 4K in length, there are more than 1 million (1,024 * 1,024) page table entries. To keep the operating system from having to retain all of them in memory at once, the 386 divides the page table into a 4K page directory with 1,024 entries and 1,024 4K page tables that contain mapping information for 1,024 pages each. The upper 10 bits (bits 22 through 31) of a 32-bit linear address are used as an index into the page directory; the middle 10 bits (bits 12 through 21) are used as an index into the page table referenced in the page directory; and the lower 12 bits (bits 0 through 11) form the offset into the 4K page itself. The page directory is retained in memory at all times; page tables are loaded on demand from disk and swapped out if the RAM they occupy is needed for other purposes. Control register CR3 contains the base address of the page directory. Figure 1 illustrates the process a 386 with paging enabled goes through to turn a 32-bit linear address into a corresponding physical address.

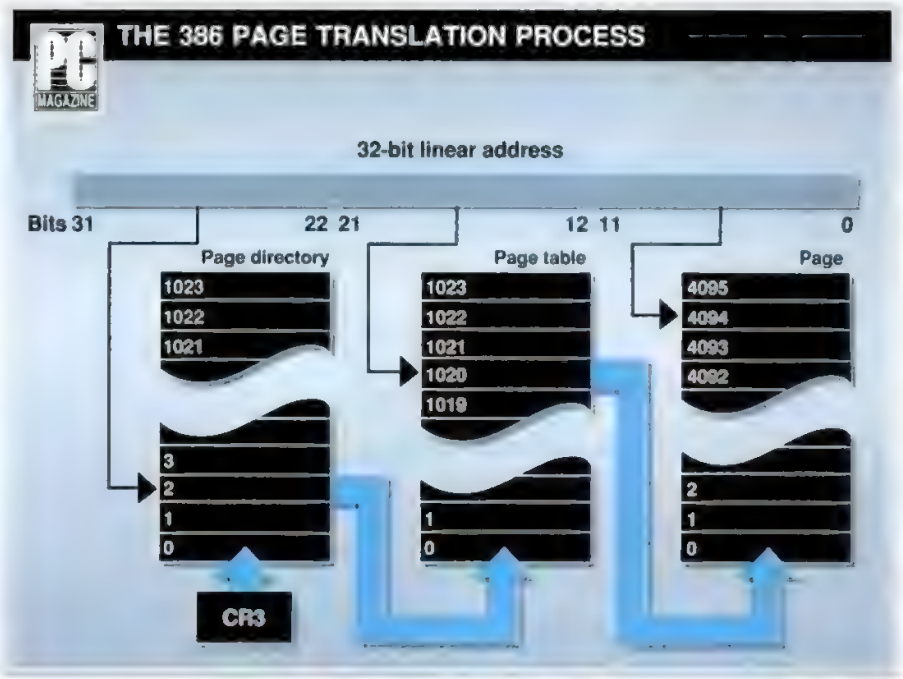

Figure 1: With paging enabled, the 386 converts a 32-bit linear address to a corresponding physical address using page tables. The upper 10 bits of the linear address are used as an index into the page directory; the middle 10 bits are used as an index into the page table referenced in the page directory; and the lower 12 bits specify the offset into the 4K page referenced in the page table. Register CR3 contains the base address of the page directory.

In Virtual-86 mode, unlike in protected mode, the operating system can get away with retaining the page directory and one page table in memory at all times because with Virtual-86 mode's 20-bit addresses, the upper 12 bits are always zero. Thus, only the zeroth entry in the page directory—and therefore only the zeroth page table—is ever used. In fact, only the first 256 entries in the page table are used, because there are only 256 4K pages in a 1MB address space—the most you can address with a 20-bit descriptor.

To help reduce the overhead that accesses to RAM-based page tables impose on the CPU, the 386 uses an on-chip cache known as the translation lookaside buffer, or TLB, which stores the 32 most recently used page table entries. If the entry needed to resolve a linear-to-physical-address conversion already resides in the TLB, the paging hardware pulls it from the cache and neatly avoids the extra bus cycles required for a RAM access.

The net result is a flexible memory structure that can be molded to fit the requirements of different application programs. Figure 2 shows one example of how a 386 memory manager can use paging in Virtual-86 mode to alter the layout of memory, making more RAM available to real mode programs. In this example, the PC is outfitted with 640K of system memory and 384K of extended memory, bringing the total to 1MB. In addition, it is equipped with a CGA whose video buffer occupies addresses B8000H through BBFFFH, a hard disk whose adapter ROM occupies the area from C0000H to C3FFFH, and a 64K ROM BIOS that starts at F0000H. The linear addresses that correspond to the three "holes" between 640K and 1MB—the first from A0000H to

B7FFFH, the second from BC000H to BFFFFH, and the third from C4000H to EFFFFH—are mapped through page tables to physical addresses in extended memory. DOS applications gain an extra 96K of memory contiguous with the lower 640K, plus two additional areas 16K and 176K in length between the top of video RAM and the bottom of BIOS ROM that can be used for other purposes.

Of course, there aren't many 386 users with CGAs. The same PC equipped with an EGA or VGA adapter wouldn't gain any additional memory contiguous with the lower 640K because both adapters use the A000H segment for graphics RAM, but it would gain 176K of high memory above the 128K video buffer, minus any additional memory used for video adapter ROM. This is consistent with how *386-to-the-Max* and *QEMM-386* work: if you have an EGA or VGA adapter and 640K of base memory, you don't gain any additional contiguous memory. If you have a CGA or monochrome adapter (or have less than 640K of base memory), these utilities will fill in the unused areas as needed to maximize the memory available to DOS.

One drawback to using an expanded memory emulator built to run on both the 286 and the 386 rather than one specific to the 386 is the 286's lack of a Virtual-86 mode. The memory manager has to run DOS applications in real mode and temporarily switch to protected mode to access a location in high memory. Interrupts must be disabled while the processor is in protected mode, so programs that rely on interrupts—background communications programs, for example, or programs that tap into the timer interrupt—may miss one or more interrupts. This isn't a problem on the 386. With paging enabled in Virtual-86 mode, a read or write to a memory location beyond 1MB doesn't require a mode switch. And without the mode switch, interrupts needn't be disabled.

Another trick common to 386 memory managers is the remapping of slow 8-bit ROM to faster 32-bit RAM. This process is known as ROM shadowing; the RAM used for this purpose is referred to as "shadow RAM." The contents of ROM are first copied to RAM, then paging is used to translate the ROM's linear address space to the physical address of the RAM where shadowing will occur. Applied to EGA adapters, whose ROMs are notoriously slow, this technique can increase video performance by up to 40 percent. *QEMM-386* and *386-to-the-Max* actually perform speed tests on the RAM and ROM they find in your system and optimize where possible by swapping slow memory below 1MB for fast memory above 1MB. The result: faster execution times, obtained without adding a single piece of hardware to your system.

The only way you will really make better use of your hardware is to forsake DOS altogether and move to a true protected mode operating system such as OS/2. With DOS, in short, if you want to squeeze the most out of a 386, buy a 386 memory manager.

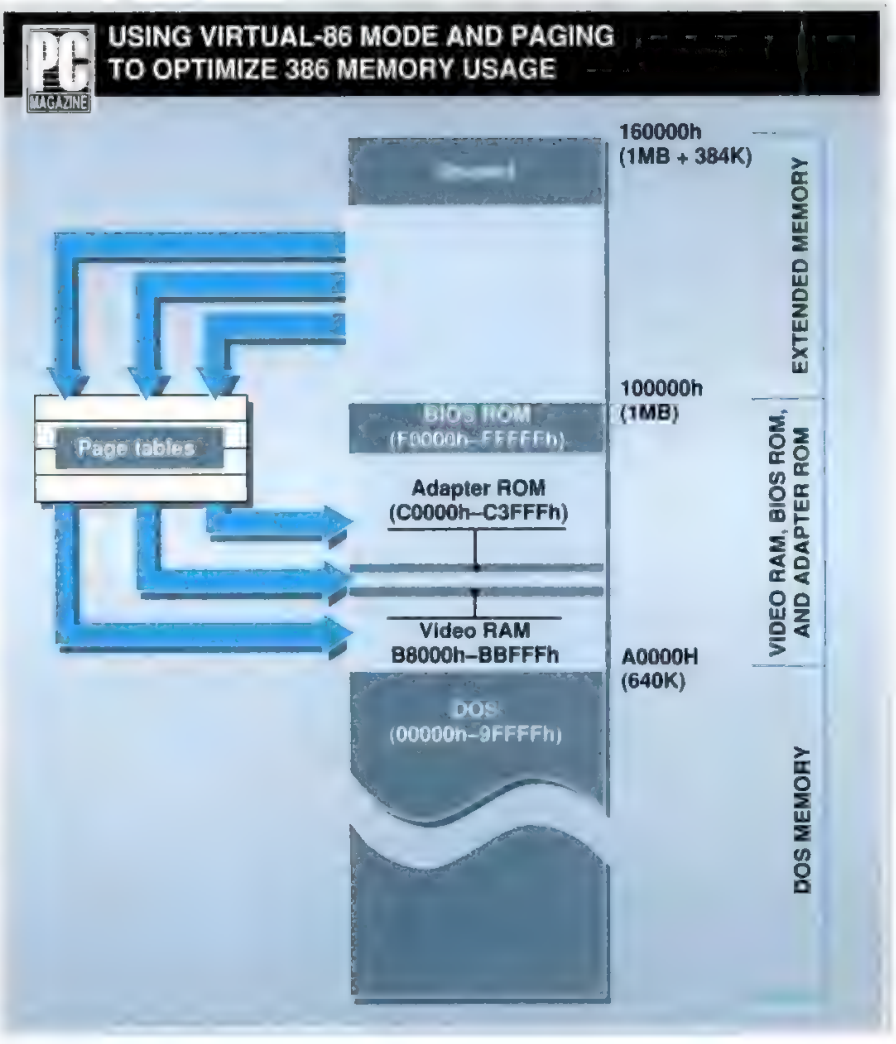

Figure 2: Virtual-86, real-mode programs running on a 386 with paging enabled have access to 4GB of memory. By mapping linear addresses that correspond to unused areas within the 8086's 1MB address space to physical locations in extended memory, more RAM can be made available to real-mode application programs. Here, empty slots from A0000H to B7FFFH, BC000H to BFFFFH, and C4000H to EFFFFH have been backfilled. A program that accesses these locations is completely unaware that it's really using extended memory.

TIMING CRITICAL EVENTS

How can a program time critical events with a resolution greater than the 55-millisecond frequency of the PC's timer interrupt?

Clyde T. Eisenbeis
Oakdale, Minnesota

The way to accomplish this is by putting to use timer 2, a programmable interval timer provided on the system board. Timer 2 oscillates at a frequency of 1.193 MHz on PCs and ATs and 1.190 MHz on PS/2s. Either frequency yields a minimum timing resolution of about 840 nanoseconds, several orders of magnitude better than you can obtain with the much coarser timer interrupt. In fact, timers 0 and 2 (timer 0, hardwired to IRQ0

on the system board, is responsible for the timer interrupt that fires every 55 milliseconds) are both driven by the same clock crystal; the difference is that timer 0 generates a hardware interrupt only every 65,536th clock tick—the amount of time that it takes for it to count backward from FFFFh down to 0.

Timer 2 is a countdown timer that works by decrementing a 16-bit value once every clock tick until it reaches zero, after which it wraps around to FFFFh and begins to count down again. You supply an initial counter value and determine how much time has elapsed by reading the value back and multiplying the difference between the starting and ending values by the length of one clock cycle. Here's a step-by-step summary of what it takes to initialize the timer, start the countdown, and gauge the amount of time that has passed since the countdown started:

- Disable the timer by clearing bit 0 of I/O port 61h.
- OUT the control byte B0H to port 43h to initialize the timer.
- OUT the least significant byte of the initial 16-bit counter value to port 42h, followed by the most significant byte.
- Start the timer by setting bit 0 of port 61h.
- Start the "event."
- When the event has concluded, stop the timer by clearing bit 0 of port 61h.
- OUT the value 80h to port 43h to latch the counter.
- Read the least significant byte of the final counter value followed by the most significant byte from port 42h.
- Subtract the final timer value from the initial value and divide by 1,250 to determine the duration of the event in milliseconds (or use whatever factor is appropriate to convert the derived value to the desired system of units).

To ensure that the critical timing sequence isn't interrupted by a hardware interrupt, you should disable interrupts going in and reenable them when you are done. Otherwise, you may be measuring the time it took to service an interrupt in addition to the time it took to complete the event.

In the above example, the timer is programmed to accept both bytes of a 16-bit counter value in LSB/MSB order when the control word B0H is written to I/O port 43H. Since the maximum value an unsigned 16-bit quantity can hold is FFFFh, or 65,535, timer 2 can't be used to time events longer than about 55 milliseconds in duration. Stepping in at a random moment in time, there is no way to tell how many times the count has wrapped around since the timer was last started, or even *if* it has wrapped around. If this seems like a severe limitation, keep in mind that interrupts shouldn't be disabled for much longer than 55 milliseconds anyway.

For reasons that are probably obvious, timing events with a degree of resolution this high is best done in assembly language. The amount of overhead involved in reading and writing I/O ports in most high-level languages is enough to skew the results. For example, the following assembly language code was generated by Microsoft C, Version 5.1, for the instruction outp(0x43,0xB0):

```
mov     ax,00B0h
push    ax
mov     ax,0043h
push    ax
call    _outp

;***** _outp routine *****

push    bp
mov     bp,sp
mov     dx,word ptr [bp+06]
mov     al,byte ptr [bp+08]
out     dx,al
mov     ah,0
pop     bp
retf

add     sp,4
        .
        .
        .
```

On a 4.77-MHz PC, it takes more than 23 microseconds (over 100 clock cycles) from the time the first instruction is executed until the OUT instruction is finally reached. Without inline assembler code, it might take longer to stop the timer once an event is completed than it did for the event to run its course from start to finish.

You can time events with periods of less than 840 nanoseconds by triggering them more than once and dividing the total elasped time by the number of repetitions. Douglas Boling, a frequent contributor to *PC Magazine*'s Productivity section, devised a way to gauge CPU clockspeed by measuring the amount of time it takes to execute a known code sequence and dividing by the total number of clock cycles to derive the period of one clock cycle. His code is used in the PC Labs benchmark programs. There are other intricacies involved in benchmarking CPU clockspeed that have nothing to do with the timer itself, but the basic premise of his logic was the same: to trigger enough operations in sequence to drive the total length of time required to a figure compatible with timer 2's 1.190/1.193-MHz clock.

Timer 2 is more commonly used for tone generation in conjunction with the computer's speaker. In the example given above, timer 2 is initialized to mode 0 by the control word B0H. In mode 0, the counter simply counts until it's told to stop. When it is used with the speaker, timer 2 is normally set to mode 3, where, given a clock divisor value of n, the timer generates a square wave pulse every nth clock cycle. If the pulse is gated to the speaker, a sound is produced.

EDITOR'S NOTE

From time to time, Jeff Prosise will provide somewhat more detailed insights into topics than has been the norm here. For example, sometime soon Prosise will provide the answer to an often asked question: What really happens during the first 30 seconds your computer is on? Often, a short answer to one question will open up even more questions. It is our goal to provide complete answers in terms that the end-user can understand.

It is rumored that on the really tough questions, Prosise consults Hawkeye, his parrot. Hawkeye is highly proficient in C and MASM, claims to love OS/2, and actually prefers writing programs in FORTH. Between the two of them, you can look forward to a great column. Prosise and I, in turn, look forward to an avalanche of letters and comments from our readers. Keep them coming!—*Tony Rizzo*

ASK THE TUTOR

The Tutor solves practical problems and explains points of general interest about using your hardware and software more productively, and answers basic questions about DOS and systems in general. To have your questions answered here, write to Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column). We're sorry, but we cannot answer questions personally. ■

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CIRCLE 367 ON READER SERVICE CARD

by
Frank J. Derfler, Jr.

Connectivity Clinic

- SHARING ASCII FILES: Unix and DOS have incompatible file formats. Here's how to convert text files from one to the other.
- SHARING PRINTERS ON NETWARE LANS : Here's how to add peer-to-peer printer sharing on NetWare networks.
- FINALLY! A GOOD BOOK ON NETWORKING: This text provides a good background on networking technology at just the right level.
- SETTING UP A NETBIOS-BASED NETWORK: You'll get an error message if you designate the incorrect number of sessions and NCBs.
- USING NETBIOS: A correction for EXPORT.ASM and a way to test NetBIOS routines with PC-MOS/386.
- INTEGRATING MINIS WITH PCs: You can install IBM's PC Support with a software system that's not "all blue."

SHARING ASCII FILES

I need to share text files between a Sun minicomputer running Unix and PCs running MS-DOS, but I find that text files created under Unix can't be viewed on a PC and vice versa. I have to run the TCP/IP utility Telnet to use the Unix files, and this is awkward. Is there an easier way?

Bill McWilliams
Dallas, Texas

PC MAGAZINE I'm not sure the alternative is easier than running Telnet, but you *can* make it more automatic. Since you have a Sun workstation, I assume you use Sun's PC-NFS as the TCP/IP service on the PCs. PC-NFS, and other TCP/IP packages, provide two simple utility programs that translate between Unix and DOS formats. Sun calls its utilities UNIX-2DOS and DOS2UNIX.

If you carefully name files in both environments, these tools offer a simple way to exchange files. Follow the DOS file naming conventions for both Unix and DOS files to avoid problems with long names in DOS. You can write a batch file under DOS and a shell script under Unix to convert files automatically for one or both environments.

SHARING PRINTERS ON NETWARE LANS

How can we make more printers available on a *NetWare* network without buying more copies of *NetWare*, creating more file servers, and dedicating more PC hardware?

Chip Futch
Panama City, Florida

PC MAGAZINE There are several ways you can share additional printers on your network. You could upgrade to *NetWare 386*, for instance. Novell's latest and greatest software lets you share printers on workstations in addition to those on the file server. However, unless you otherwise need the muscle of *NetWare 386*, its $7,995 list price will probably be a deterrent to you.

Printer Assist 3.0, marketed by Fresh Technology Group (telephone (602) 497-4200) provides a more reasonable approach at $179. Loading one copy of the software on a Novell file server allows you to share printers on any network station. The stations, acting as remote print servers, receive their print jobs from a queue on the *NetWare* server, so they don't need hard disk drives.

Brightwork Software (telephone (800) 552-9876) markets a similar product called *PS-Print* that sells for $595 per network. *PS-Print* has an extensive menu of features that let you reprint any portion of a document in the queue and maintain strict control over the print queue.

Perhaps the best solution to printer sharing needs on a Novell network is provided by D-Link Systems' *LANsmart*. This interesting and flexible product is a complete network operating system that is entirely compatible with *NetWare*. You can buy one $395 software package and set up an unlimited number of print and file servers. If you're already using a *NetWare* network, *LANsmart* lets you create any number of servers in addition to those running under *NetWare*. The D-Link server program responds to requests from Novell's workstation shell, so you don't have to add any software to the workstations. If you want to start with only *LANsmart* and grow into *NetWare*, you can do that too. Contact D-Link Systems Inc. at (714) 549-7942 for more information.

FINALLY! A GOOD BOOK ON NETWORKING

I'm often asked to recommend a good book on networks. Until now, most of the books I've seen have been either too basic or too esoteric to be useful. They either insult you with elementary concepts or snow you with academic jargon. However, I recently discovered one called *Interlan on Interoperability*—a very good book at a very good price. Although it's produced by Interlan, a vendor of LAN products, it is objective, comprehensive, and pretty well on target for the person with hands-on LAN acquisition and management responsibilities.

You get the most current and practical information available on networking products here in the pages of *PC Magazine* (we now devote 20 percent of our editorial coverage to connectivity), but if you want

some good background on the technology, this book provides an excellent source, despite the self-serving title.

The text describes LAN hardware, how network operating systems work, what standards are important, and how different computer systems interact. A glossary provides a handy reference. The book doesn't have an ISBN number, and you can't get it in a book store. Order *Interlan on Interoperability* by sending $10.95 to Interlan Inc., 155 Swanson Rd., Boxborough, MA 01719. Interlan doesn't take credit cards, and if you send a personal check, it will hold the check until it clears. Your best bet is to use a cashier's check or money order. It's worth it!

SETTING UP A NETBIOS-BASED NETWORK

Your March 28 feature "Penny-Pinching LANs" cited Artisoft's *LANtastic* as Editor's Choice and indicated that you run the program using Western Digital WD8003 Ethernet cards. I concluded that *LANtastic* would run well on our hardware. However, after installing *LANtastic* and loading WD's NetBIOS driver, I got the message

```
Insufficient NetBIOS resources
 for this server configuration.
 Restart NetBIOS with higher
 sessions and NCBs"
```

What do I do now?

John Harris
Houston, Texas

The problem you encountered is common with every NetBIOS-based network. At least Artisoft spells out the problem for you—some NetBIOS-based operating systems simply die at this point.

The NetBIOS has certain default values for the number of buffers and network control blocks (NCBs). Apparently, you are sharing a lot of resources among many simultaneous users and *LANtastic* needs more NetBIOS sessions assigned on the adapter card in order to transport information across the network.

Artisoft provides a program called NBSETUP with its software that forces a NetBIOS reset and lets you designate the correct number of sessions and network control blocks. You must run NBSETUP every time you load NetBIOS, but you can handle both actions, as well as start the server software, from within a batch file. Check the file called NBSETUP.DOC for information on determining how to configure NBSETUP.

USING NETBIOS

In the January 31, 1989, Connectivity Clinic, you published a program called EXPORT that demonstrates how to use NetBIOS to move data across a network. However, it's missing the code that instructs NetBIOS to delete the EXPORT name from its table after it is used.

The line that reads

```
DELETE NAME:
```

should read

```
DELETE NAME: MOV
CNCB.NCB_COMMAND,NW_DELETE NAME
```

I've also found the following to be very helpful for people developing NetBIOS routines and applications: *PC-MOS/386* from The Software Link provides a single-system platform for testing NetBIOS routines. You can even run the software on an 80286-based AT and get two 200K partitions for NetBIOS development. Of course, an 80386 machine provides more and larger partitions. It's nice to be able to exercise NetBIOS routines on a single machine to avoid having your NetBIOS bugs infuriate fellow LAN users.

The *PC-MOS/386* NetBIOS emulator is a device driver called $NETBIOS.SYS. When a task in a partition logs into NetBIOS, the driver assigns it the next permanent NetBIOS address. Although the *PC-MOS* manual states that you must use a NETNAME command to activate NetBIOS support, I have run the IMPORT and EXPORT utilities without it.

Steven Fisher
La Mesa, California

You are absolutely correct about the missing line of code in EXPORT.ASM. The error doesn't show up until you make multiple transmissions to the same destination. The fact that this utility works with some versions of NetBIOS demonstrates the lack of standardization among different vendors' renditions of NetBIOS.

If you haven't already done so, you should check out our reviews in the September 26, 1989, issue. We examine *PC-MOS/386* and several other multiuser operating systems, and the availability of NetBIOS services is an important differentiating factor among them.

INTEGRATING MINIS WITH PCs

PC Support is a set of programs from IBM that allows integration of its AS/400 minicomputers with personal computers. This includes sharing hard disks and printers, using e-mail, transferring data to and from an AS/400 in several formats (ASCII, EBCDIC, .DIF, comma-delimited, and so forth), or simply using a PC as an AS/400 workstation. It is an excellent product, built to SAA standards, and it offers a one-stop solution to almost all host-related needs of a PC user.

Unfortunately, the current version (1.2) can not be installed on a PC hard disk or on a floppy disk formatted with MS-DOS instead of PC-DOS. An attempt to do so on a hard disk formatted with MS-DOS brings up the interesting message "Drive should have been formatted with /S option."

To overcome this problem, create two empty files—IBMBIO.COM and IBMDOS.COM—in the root directory of the drive in which you want to install *PC Support*. The installation program then proceeds smoothly. You may subsequently delete these two files, reboot the system, and connect happily ever after.

Natarajan Nagamanikkam
Komarapalayam, Tamil Nadu,
India

It is interesting to see that IBM's minicomputer connection software package checks for the IBM-specific DOS hidden files. Using dummy system files is a good way to work around the imposition of an "all blue" software system.

NETWORK YOUR QUESTIONS

Connectivity Clinic gives you practical solutions to networking problems of all types. We'll pay $50 or more for any tips we print, *plus an extra $25 if you submit your letter on a disk*. If you do, please include a printed copy. We'll gladly answer your questions at no charge, but we cannot answer letters personally. Mail contributions to Connectivity Clinic, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column). You may also contact Frank J. Derfler, Jr., via MCI Mail (use Derfler's box named CONNECTIVITY CLINIC).■

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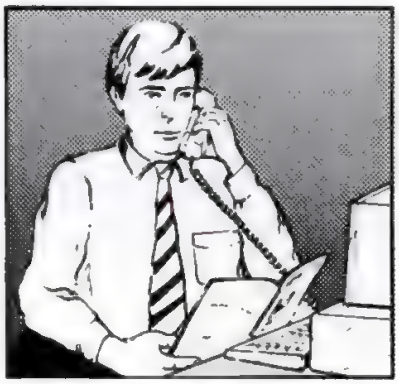

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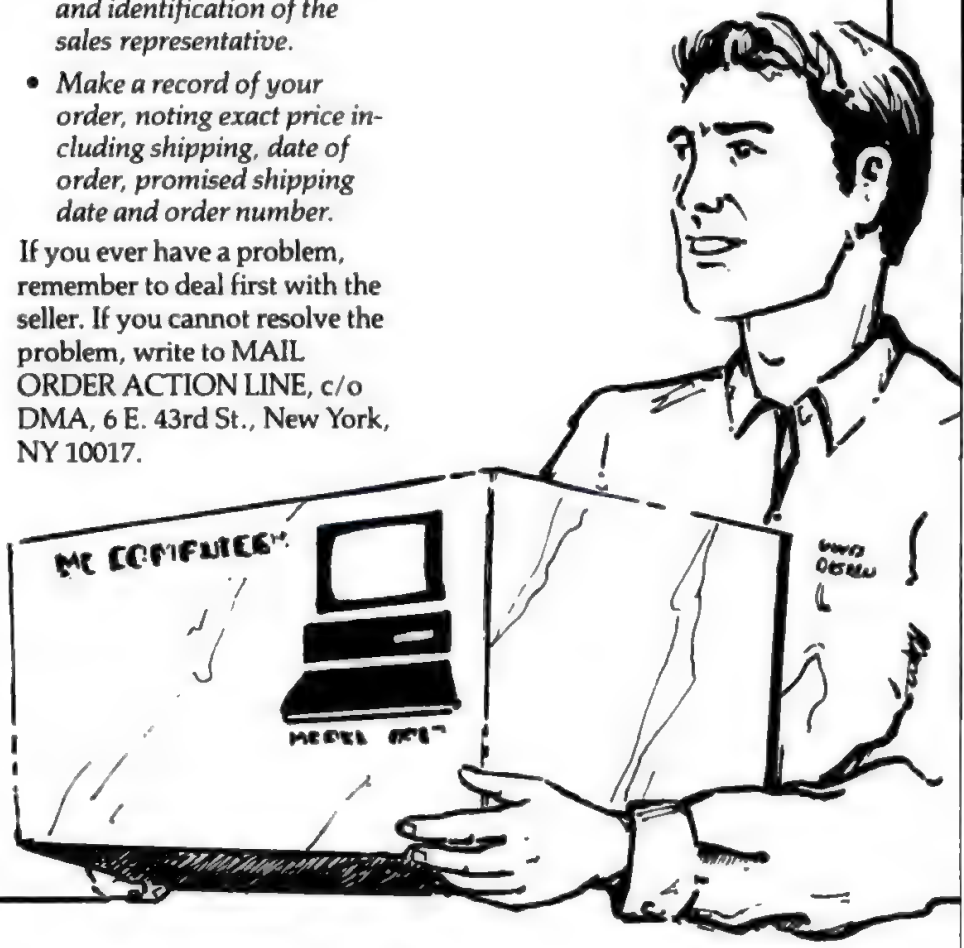

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Shamrock 386-33Mhz	40.1	7.7	**$2999**

286 COMPUTERS

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MODEL/SPEED	Norton SI	MIPS	PRICE
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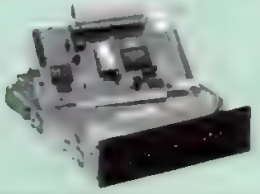
SEAGATE Disk Kits



Each **SEAGATE** disk drive is pretested and formatted in our plant. We preload our bundled software which includes **TakeTwo** floppy backup utility, **Leprecache** disk cache software, and **Menus Direct**, each kit comes with all necessary mounting hardware, faceplates, and an illustrated instruction manual

PC/XT kits come with a short slot **Seagate** controller. Please specify the make and model of your computer and whether you need a full or half-height face plate

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ST412/506 Interface Drive Kits

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Ave. Access Time:	65ms	65ms	40ms	28ms
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AT/286/386	$199	$249*	$349	$449*

* Indicates RLL controller required.

SCSI Intelligent Drive Kits for PC/XT/AT/386/Tandy 1000,A,SX,TX,TL,SL

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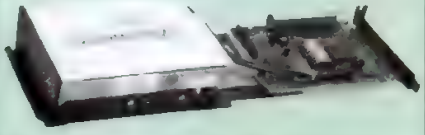
Kits include host adapter, cables, mounting hardware

SHAMROCK Disk Cards



Leprecard Hard Disk Cards feature **SEAGATE** fast access disk drives and controllers, the most trusted name in the industry. Low power consuming drives reduce system temperatures increasing component life. Leprecards come with **TakeTwo** floppy backup utility, **Leprecache** Disk cache and **Menus Direct** software

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Ave. Access Time:	**40ms**	**40ms**	**40ms**	**24ms**
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SCSI High Speed Interface for PC/XT/AT/386 & Tandy 1000, A, TL, SL, SX	$349	$379	$399	$689

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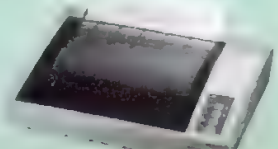

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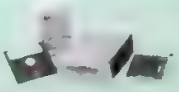

1.44 Megabyte Kits for PC/XT Systems

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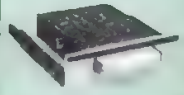

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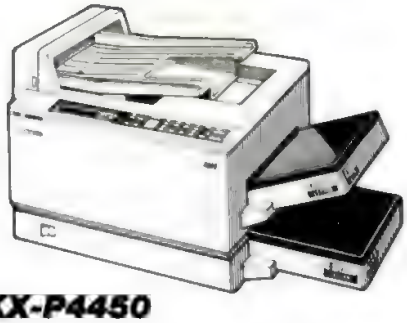

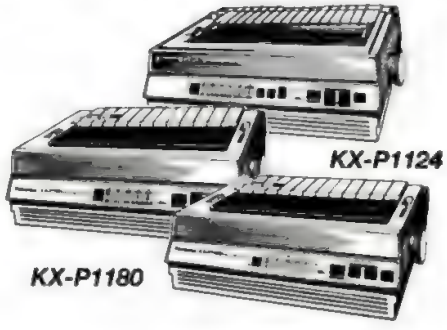

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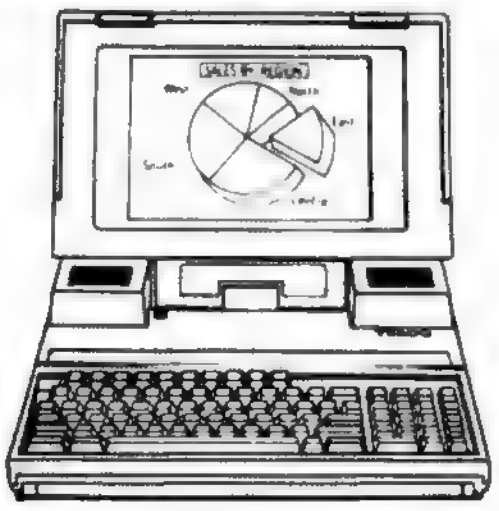

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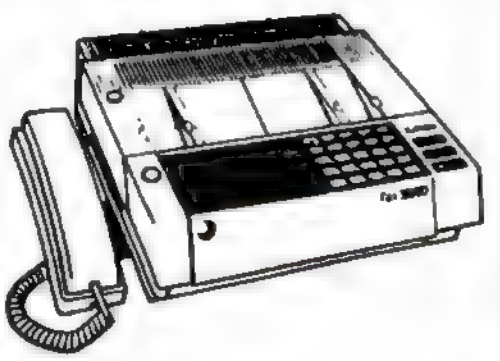

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- Real-time clock
- 101-key enhanced keyboard

Monitor optional.

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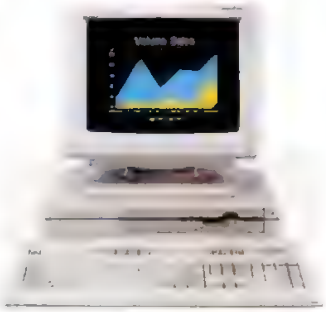
- Built-in parallel port and two serial ports
- Built-in game port interface
- Three full-size 16-bit and two half-size 8-bit expansion slots
- 80287 math coprocessor support
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- Real-time clock
- 101-key enhanced keyboard

Monitor optional.



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212 Monitor and Hard Drive Options			
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- Built-in parallel port and two serial ports
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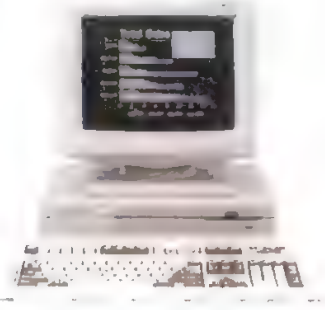
- Built-in game port interface
- 80287 math coprocessor support
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- Real-time clock
- 101-key enhanced keyboard
- 145-watt power supply

Monitor optional.

$995
64776

216 Monitor and Hard Drive Options			
	MGA	EGA	CVGA
40MB			
[illegible]	$1599	$1949	$2039
80MB			
[illegible]	$1829	$2179	$2269
110MB			
(15ms)	$2029	$2379	$2469



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- Built-in parallel port and two serial ports
- Built-in game port interface
- Three full-size 16-bit and two half-size 8-bit expansion slots
- 80387SX math coprocessor support
- Choice of 5.25" 1.2MB or 3.5"1.44MB diskette drive
- Real-time clock
- 101-key enhanced keyboard
- 145-watt power supply

Monitor optional.

$1495
64787

316s Monitor and Hard Drive Options			
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40MB			
[illegible]	$2099	$2449	$2539
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[illegible]	$2329	$2679	$2769
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$899
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- CompuAdd 810 computer (XT-compatible)
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- Built-in dual diskette drive controller
- Built-in parallel printer port and two serial ports
- Three full-size and two half-size XT class expansion slots
- 8087 math coprocessor support
- Monographics monitor and adapter
- Star® Micronics NX-1000™ printer and cable
- 5.25" 360KB diskette drive
- CompuAdd MS-DOS v4.01 and GW-BASIC® software
- New Spinnaker® Eight-in-One™ integrated software
- Real-time clock
- 101-key enhanced keyboard
- Computer paper and ten blank diskettes

Color monitor optional.

Career Starter Kit Options			
	MGA	CGA	CVGA
No Hard			
Drive	$899	$1039	$1539
20MB			
	$1179	$1319	$1619
40MB			
	$1329	$1469	$1769

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Computerize Your Business For $1495
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- 0 wait state page-mode memory
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- Built-in dual diskette drive controller
- Built-in parallel printer port and two serial ports
- Three full-size 16-bit and two half-size 8-bit expansion slots
- 80287 math coprocessor support
- Monographics monitor and adapter
- Panasonic® 1180 printer and cable
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- CompuAdd MS-DOS v4.01 and GW-BASIC software
- CompuAdd INTEGRATOR℠ productivity software
- Real-time clock
- 101-key enhanced keyboard
- Computer paper and ten blank diskettes

Color monitor optional.

Professional Starter Kit Options			
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80MB			
	$1905	$2255	$2345

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Color makes charts and graphs easier to read and our ***EGA combo*** *makes adding color video to your system easy on the budget. Features 14" (13" viewable) EGA color monitor and EGA-480 card. Provides 640×480 resolution, 0.31mm dot pitch, and 16 out of a possible 64 colors.* **$489** *51702*

Super VGA Combo includes the Mitsubishi Diamond Scan 14" (13" viewable) color VGA monitor and a CompuAdd 16-bit VGA card. *51706* **$745**

Monitors

EGA 14" monitor offers the best value in an enhanced color monitor. Features 14" (13" viewable) screen, 0.31mm dot pitch and high resolution up to 640×350. *51210* **$349**

NEC® MultiSync 3D Super VGA color monitor with 14" (13" viewable) delivers up to 1024x768 resolution with a 0.28mm dot pitch in interlaced mode and limitless color capability. 8514A compatible. *51209* **$675**

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Monographics card is a Hercules™-compatible monochrome graphics card with resolution up to 720x348. Includes parallel port. *48301* **$49**

CompuAdd 16-bit VGA adapter card up to 800×600 resolution, with 16/256K colors. *48333* **$259**

Flat Screen Monographics Combo 12" monitor, tilt and swivel base, monographics adapter card. *51700* **$139**

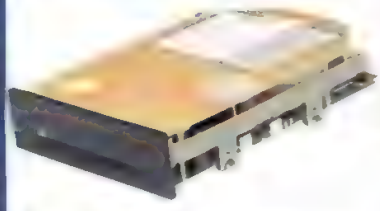
Color Video Graphics Array (CVGA) Combo 14" (13" viewable) analog color monitor and a CompuAdd VGA graphics card. *51704* **$579**

PC MAGAZINE EDITOR'S CHOICE

"Every CompuAdd hard drive kit includes the drive, connecting cable, mounting hardware, manual, and FREE PC-FullBack™ disk backup software."

PC Magazine, **Editor's Choice** for Mail Order Hard Disks, June 27, 1989.

Hard Drives



Take advantage of the convenience and greater flexibility provided by the speedy ***40MB Seagate®*** *(28ms) AT-compatible hard drive.* **$399** *47207*

XT Class Hard Drives

20MB MiniScribe® (65ms) half-height with controller. *47001* **$279**

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30MB MiniScribe (65ms) half-height, with RLL controller. *47100* **$299**

30MB Seagate (65ms) half-height, with RLL controller. *47101* **$299**

40MB MiniScribe (61ms) half-height with controller. *47206* **$379**

60MB MiniScribe (61ms) half-height, with RLL controller. *47250* **$389**

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FlashCard-30, 30MB MiniScribe (65ms). *47104* **$329**

AT Class Hard Drives

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40MB MiniScribe (61ms) half-height drive. *47203* **$319**

80MB Seagate (28ms) full-height drive. *47401* **$629**

Seagate 117MB (28ms) full-height RLL drive. *47426* **$869**

ESDI Hard Drives

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150MB Imprimis (18ms, 10MBit) full-height drive. *47432* **$1189**

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630MB Imprimis (14.5ms, 15MBit) full-height drive. *47476* **$2699**

NEW! HardCache/ESDI Controller

Perfect for any network, CAD/CAM, or graphics application, the new CompuAdd ***HardCache/ESDI Controller*** *reduces system access time to cache data to less than 0.5ms—up to 30 times quicker than even the fastest hard drive! Features automatic system self-configuration, programmable prereads, and automatic cache set definition. Upgrades require 100ns SIMMs.* **$495** *46510*

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HardCache/ESDI Controller with 512KB RAM. *46511* **$565**

HardCache/ESDI Controller with 1MB RAM. *46513* **$645**

Controllers

Dual diskette drive controller for personal computers. *46301* **$49**

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XT-compatible hard drive controller card provides smooth hard drive operations. *46502* **$79**

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3.5" Diskette Drives

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MEM-576 short card for XT-compatibles with 0KB expandable to 192, 384, 512, or 576KB. *48100* **$35**

XT-compatible EMS card with 0KB expandable to 2MB compatible with the LIM 4.0 specification. *48101* **$99**

AT-compatible EMS card with 0KB expandable to 2MB. *48102* **$119**

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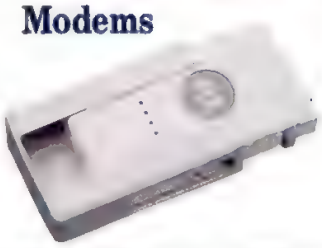
AT-compatible multifunction board with 0KB expandable to 1.5MB, serial port, and parallel port. *48701* **$99**

by design.

Modems



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2400 baud internal modem. *49553* **$119**

Everex Evercom 2400 baud ¾-card internal modem. *49551* **$149**

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1200 baud external modem. *49525* **$89**

2400 baud external modem. *49557* **$129**

Everex 2400 baud external modem. *49575* **$179**

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Replacement

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200-watt for AT-compatibles. *98015* **$119**

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APC Model 520ES for file servers. *40711* **$499**

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Epson LQ-850 (11" carriage, 264 draft/88 LQ). *56334* **$549**

Epson LQ-1050 (15" carriage, 264 draft/88 LQ). *56333* **$775**

Hewlett-Packard

Hewlett-Packard DeskJet Plus. *56453* **$729**

Hewlett-Packard LaserJet Series IIP. *56803* **$1049**

Hewlett-Packard LaserJet Series IID. *56802* **$2999**

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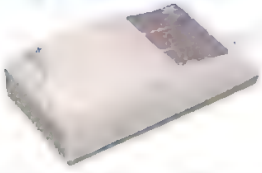
NEW! **Intel Visual Edge™ image enhancement controller for the Hewlett-Packard LaserJet Series II.** *38504* **$455**

Input Devices



CompuAdd Optical/Mechanical Mouse *features 200dpi resolution, Dr. Halo III™ paint software, mouse pocket, and pad.* ***(Regularly $55)*** **$44.99** *55052*

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Logitech Serial Mouse for AT-compatible and PS/2 systems. *55058* **$89**

Hewlett-Packard ScanJet Plus Desktop Scanner scans photographs, drawings, or printed material into your desktop publishing environment, includes XT- and AT-compatible interface kit. *56008* **$1395**

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Quicken® v3.0**. *60807* **$36**

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- Phoenix BIOS
- Monochrome Graphics Card
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- Parallel & Serial Ports
- Clock Calendar
- 1.2mb Floppy Disk Drive
- 5 Drive Bays
- 8 Expansion Slots
- Security Lock
- Utility Software
- 80287 Coprocessor Option
- 200 Watt Power Supply
- Call for other Options

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80mb 28ms Drive	Add:$400
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EGA Color	Add:$350
16 Bit VGA Color	Add:$450

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$1595 Includes 1mb Ram, Monitor & 40mb Hard Drive

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- 40mb 28ms Seagate Hard Disk
- High Resolution Amber Monitor
- Phoenix BIOS
- Monochrome Graphics Card
- 101 Key Enhanced Keyboard with tactile click
- Parallel & Serial Ports
- Clock Calendar
- 1.2mb Floppy Disk Drive
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80mb 28ms Drive	Add:$400
CGA Color	Add:$170
EGA Color	Add:$350
16 Bit VGA Color	Add:$450

FASTDATA 386[20D]

$1995 Includes 1mb Ram, Monitor & 40mb Hard Drive.

Check Our Standard Features

- 20mhz 80386
- 1mb Memory
- 40mb 28ms Seagate Hard Disk
- High Resolution Amber Monitor
- Phoenix BIOS
- 101 Key Enhanced Keyboard with tactile click
- Parallel & Serial Ports
- Clock Calendar
- 1.2mb Floppy Disk Drive
- 5 Drive Bays
- 8 Expansion Slots (1-32 bit)
- Security Lock
- 80387 Coprocessor Option
- 200 Watt Power Supply
- Upright Case & 25mhz Options

OPTIONS

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80mb 28ms Drive	Add:$400
CGA Color	Add:$170
EGA Color	Add:$350
16 Bit VGA Color	Add:$450

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Allegro 24	309
Citizen GSX140	325
Diconix	
150 Plus	319
Epson	Call
Fujitsu	
DL3400	519
NEC	
P2200	309
P5200	495
P5300	659
LC890	Call
Okidata	
182 Turbo	225
320 (IBM)	335
390 (IBM)	469
393 (IBM)	999
Panasonic	
KXP1180	175
KXP1191	225
KXP1124	297
KXP1595	425
KXP1524	535
KXP4450	1299
Star	
NX1000	167
NX2400	289
Toshiba	
P321SL	439
P341SL	599
P351SX	929

LAPTOPS

Megahertz Modems	
2400B Most Toshiba	149
2400B NEC, Epson Mitsubishi or Zenith	189
Mitsubishi	Call
NEC MultiSpeed's	Call
Toshiba	
T1000	639
T1000 768k Card	259
T1200F	1349
T1200FB Backlit	1449
T1200HB Backlit	1949
T1600	Call
T5200 100mb	5495

BOARDS

ATI	
2400 ETC Int.	147
VGA Wonder 256	259
VGA Wonder 512	309
Everex	
1200B Int Modem	59
2400B Int Modem	119
VGA 16 bit 256K	249
Genoa	
Super EGA Hi-Res	139
Super VGA #5300	199
Super VGA #5400	255
FastData *(satisfaction gauranteed)*	
2400B Int. Modem	85
CGA or MGP Card	39
Super EGA Card	99
Parallel/Serial/Game Card	39
XT 1.44 Floppy Controller	33
Hercules Graphic Card +	169
Intel	
8087-2	119
80287-10	219
80387-20	379
Orchid	
ProDesigner	229
ProDesigner Plus	319
Tiny Turbo 286	207
Paradise	
Autoswitch 480	115
VGA Plus	175
VGA Plus 16	229
VGA Professional	299
Practical Peripherals	
1200B Int Modem	59
2400B Int Modem	129
Prometheus	
Promodem 1200B Int.	49
Promodem 2400B Int.	99
Promodem 2400G Ext.	Call
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Answering Machine	209
Hand Scanner 400	139
USRobotics	
1200 Baud Internal	69
2400 Baud Internal	119
2400 Baud External	149
Video 7	
Fast Write VGA	237
Vega Deluxe	189
Vega VGA	199
V-RAM VGA	369

MONITORS

Magnavox	
7BM749 VGA White	129
9CM082 VGA	419
Mitsubishi	
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NEC	
Multisync 2a	489
Multisync 3d	645
Multisync 4d/5d	Call
Princeton	
Max15	237
Ultrasync 12"	479
Ultrasync 14"	519
Ultra 16	835
Seiko CM1430	549
Sony	
1302 Multiscan	659
1304 Multiscan	Call
Zenith 1490	595

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Colorado	
Jumbo 40-120mb Int. Tape	269
Miniscribe	
40MB XT Kit #8450	299
40MB AT #3650	259
71MB AT #3085	549
Mitsubishi	
60MB AT MR535	379
Seagate	
20MB XT Kit #225	239
30MB XT Kit #238	249
40MB AT #251-1	319
65MB AT #277R-1	365
80MB AT #4096	559
Toshiba	
360K Floppy	69
720K 3.5" Floppy	69
1.2MB 5.25" Floppy	79
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Clipper	399
DataEase	449
dBase IV	439
dBXL Diamond	129
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Paradox 3.0	419
Q & A	197
RapidFile	179
Rbase for DOS	397
Reflex	159

Desktop Publishing

Byline	175
GEM Desktop Pub.	159
Pagemaker	479
PFS:First Publisher	69
Publisher's Paintbrush	149
Ventura	Call

Financial

Bedford Integr. Acct.	133
Computer Assoc. BPI	Call
DAC 3.0	53
DAC Payroll 3.0	53
Dollars & Sense	Call
Managing Your Money	113
Peachtree Complete II	139

Graphics

Corel Draw	Call
Deluxe Paint II	45
First Graphics	Call
Freelance Plus	307
GEM Artline	269
Generic Cadd Level 3	149
Harvard Graphics	255
Perspective Jr.	69

Integrated

First Choice	Call
Works	89
Windows 286	59
Windows 386	117

Mice

Keytronics Professional	75
Logitech C7 Serial	59
Logitech HiRes C9 Bus	69
Logitech HiRes C9 Serial	75
Microsoft Serial or Bus	94
Microsoft W/ Windows 286	129
OmniMouse Serial	39
PC Mouse II Serial or Bus	79

Power Protection

Curtis Ruby Plus	59
Datasheild 100	57

Programming

Macro Assembler	89
Norton Guides (Specify)	58
Turbo Assembler/Debugger	87
Turbo Basic	60
Turbo C 2.0	90
Turbo Pascal 5.5	90
Quick Basic	60
Quick C	60
Quick Pascal	60

Spreadsheets

Allways	79
Excel	Call
Lotus	Call
Lucid 3-D	53
Quattro	145

Utilities

CoreFast	60
Carbon Copy Plus	104
Desklink	95
Desqview	68
Desqview386	99
Direct Access	46
Fastback Plus	97
Formtool	54
Formfiller	85
Laplink Plus	59
Laplink III	75
MS-Dos 4.01	79
Mace Utilities	53
Norton Advanced	79
PC Tools Deluxe	69
ProComm Plus	Call
SideKick Plus	119
Sideways	37
Super PC Kwik	43
XTree Pro	67

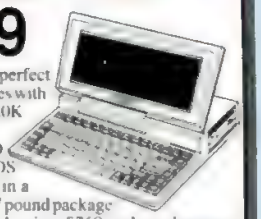
Word Processors

Ami	Call
GEM First Word Plus	57
Grammatik III	49
Manuscript	Call
Multimate Adv. II	267
Professional Write	125
Rightwriter	45
Sprint	117
Q & A Write	109
Word 5.0	Call
Word Perfect	215
Word Perfect Library	59
WordStar Prof. 5.5	189

SPECIALS

Toshiba T1000

$639



The T1000 is the perfect second PC! It comes with 512K of Ram, a 720K floppy drive, a supertwist LCD screen and MS-DOS in ROM! All this in a battery-powered 7 pound package. A 768K Ram card is just $269 and can be set as base, expanded, or a non-volatile Ram disk.

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by Video Seven

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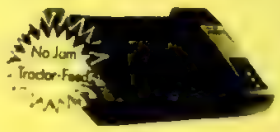

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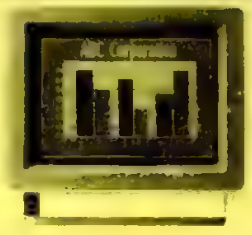

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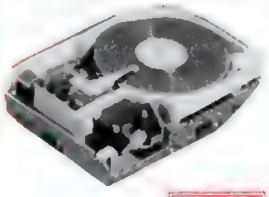

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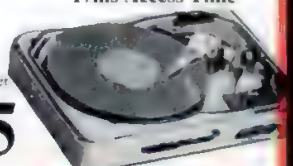

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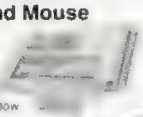

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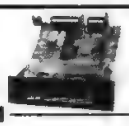

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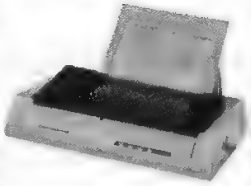

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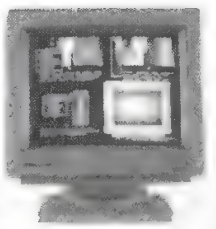

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Cocaine lies.

After nearly a decade of being America's glamour drug, researchers are starting to uncover the truth about cocaine.

It's emerging as a very dangerous substance.

No one thinks the things described here will ever happen to them. But you can never be certain. Whenever and however you use cocaine, you're playing Russian roulette.

You can't get addicted to cocaine.

Cocaine was once thought to be non-addictive, because users don't have the severe *physical* withdrawal symptoms of heroin—delirium, muscle-cramps, and convulsions.

However, cocaine is intensely addicting *psychologically.*

In animal studies, monkeys with unlimited access to cocaine self-administer until they die. One monkey pressed a bar 12,800 times to obtain a single dose of cocaine. Rhesus monkeys won't smoke tobacco or marijuana, but 100% will smoke cocaine, preferring it to sex and to food—even when starving.

Like monkey, like man.

If you take cocaine, you run a 10% chance of addiction. The risk is higher the younger you are, and may be as high as 50% for those who smoke cocaine. (Some crack users say they felt addicted from the *first time* they smoked.)

When you're addicted, all you think about is getting and using cocaine. Family, friends, job, home, possessions, and health become unimportant.

Because cocaine is expensive, you end up doing what all addicts do. You steal, cheat, lie, deal, sell anything and everything, including yourself. All the while you risk imprisonment. Because, never forget, cocaine is illegal.

There's no way to tell who'll become addicted. But one thing is certain.

No one who is an addict, set out to become one.

C'mon, just once can't hurt you.

Cocaine hits your heart before it hits your head. Your pulse rate rockets and your blood pressure soars. Even if you're only 15, you become a prime candidate for a heart attack, a stroke, or an epileptic-type fit.

In the brain, cocaine mainly affects a primitive part where the emotions are seated. Unfortunately, this part of the brain also controls your heart and lungs.

A big hit or a cumulative overdose may interrupt the electrical signal to your heart and lungs. They simply stop. That's how basketball player Len Bias died.

If you're unlucky the first time you do coke, your body will lack a chemical that breaks down the drug. In which case, you'll be a first time O.D. Two lines will kill you.

Sex with coke is amazing.

Cocaine's powers as a sexual stimulant have never been proved or disproved. However, the evidence seems to suggest that the drug's reputation alone serves to heighten sexual feelings. (The same thing happens in Africa, where natives swear by powdered rhinoceros horn as an aphrodisiac.)

What is certain is that continued use of cocaine leads to impotence and finally complete loss of interest in sex.

It'll make you feel great.

Cocaine makes you feel like a new man, the joke goes. The only trouble is, the first thing the new man wants is more cocaine.

It's true. After the high wears off, you may feel a little anxious, irritable, or depressed. You've got the coke blues. But fortunately, they're easy to fix, with a few more lines or another hit on the pipe.

Of course, sooner or later you have to stop. Then—for days at a time—you may feel lethargic, depressed, even suicidal.

Says Dr. Arnold Washton, one of the country's leading cocaine experts: "It's impossible for the nonuser to imagine the deep, vicious depression that a cocaine addict suffers from."

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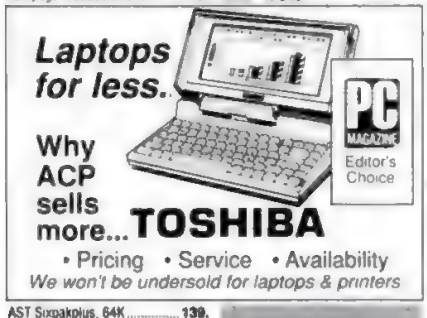

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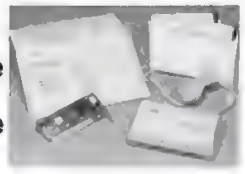

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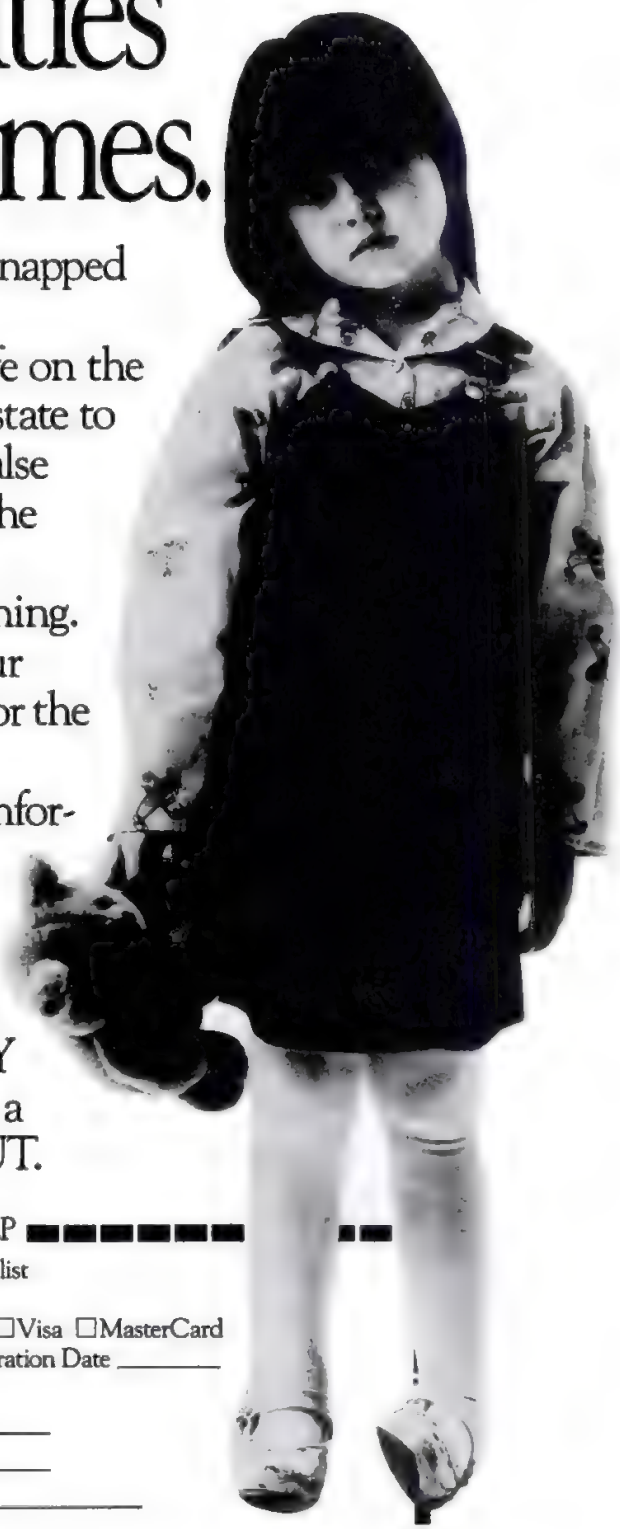

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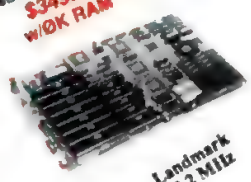

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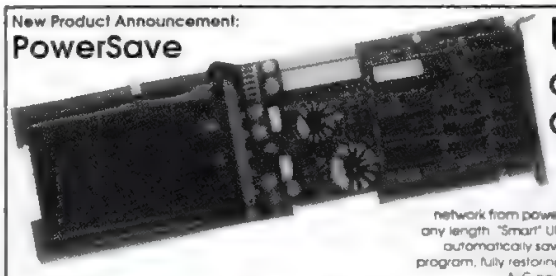

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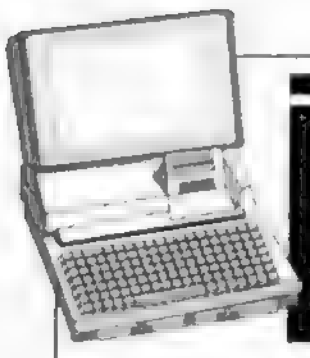

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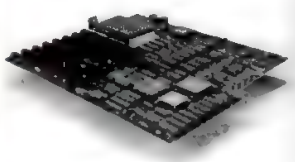

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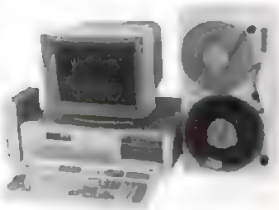

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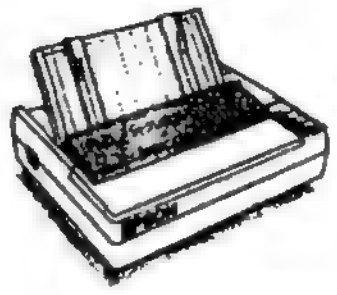

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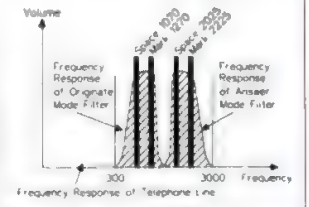

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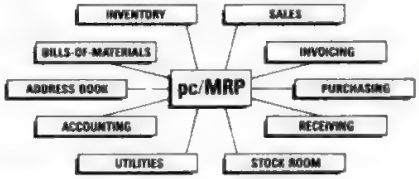

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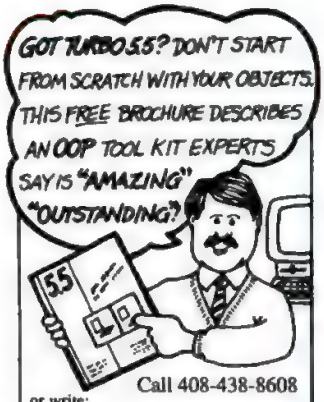

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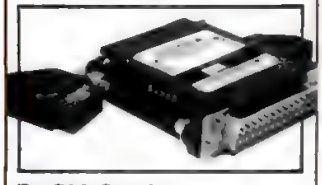

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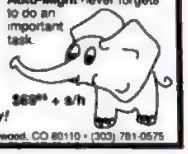

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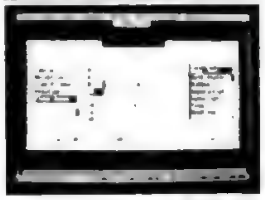

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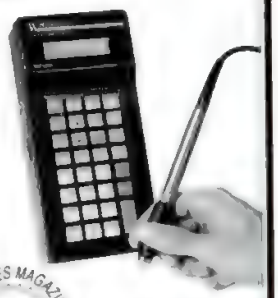

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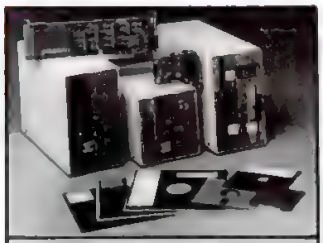

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COMING UP

■ 386SX MACHINES

It wasn't so long ago that PCs built around the 386SX chip were rare and expensive. These days, they're everywhere and over the next couple of years may actually redefine the new low end. PC Labs benchmark tests and evaluates 30 SX machines in one of our largest PC roundups yet. Computers evaluated include systems from Acer, ALR, American Mitac, AST, AT&T, Epson, and IBM.

■ SCREEN-CAPTURE SOFTWARE

Grab a screen electronically, convert its file format, and drop it into your desktop publishing document or slide show. Sounds easy, doesn't it? Unfortunately, in the world of graphics there always seem to be layers of confusion to sort through. *PC Magazine* contributing editor Robin Raskin tells you everything you need to know about capturing and saving screens, with evaluations of *Collage Plus, Hijaak Plus, Hot Shot Graphics, Pizazz Plus,* and *The Graphics Link+.*

■ CASE TOOLS FOR SOFTWARE DEVELOPMENT

Before you invest up to several thousand dollars in a complex computer-aided software engineering package, check out evaluations of ten leading programs, including Index Technology's *Excelerator* and KnowledgeWare's *Information Engineering Workbench.*

■ FROM TOKEN-RING TO MAINFRAME

There are an increasingly bewildering number of alternative ways to link PCs with IBM mainframes. Among the most popular: connections over Token-Ring networks.

Workgroup systems editor Frank J. Derfler, Jr., focuses on the Direct Token-Ring Connection, the micro-to-mainframe attachment method IBM urges its major accounts to consider. Products evaluated include systems from Attachmate, Banyan, DCA, IBM, and Novell. ■

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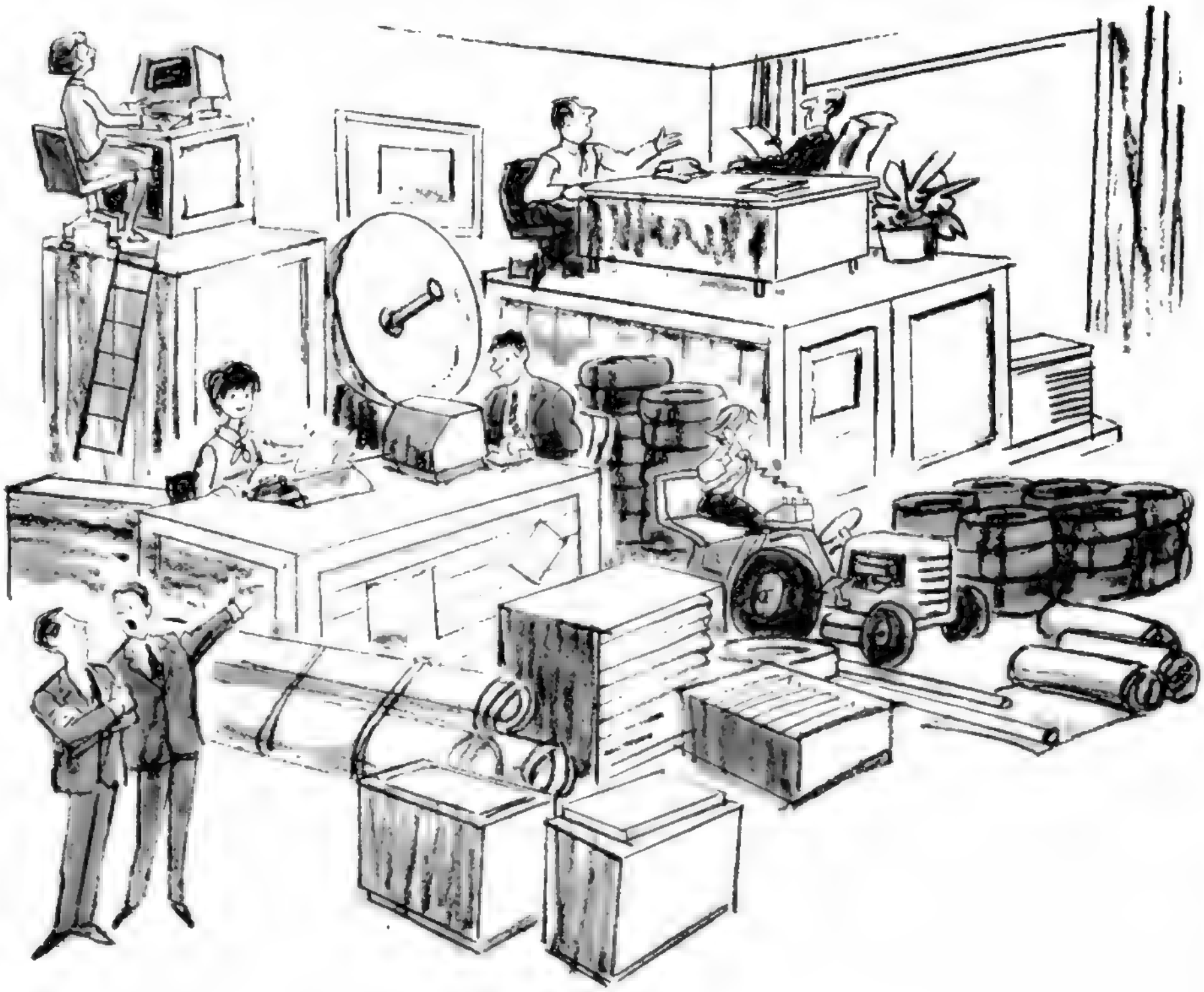

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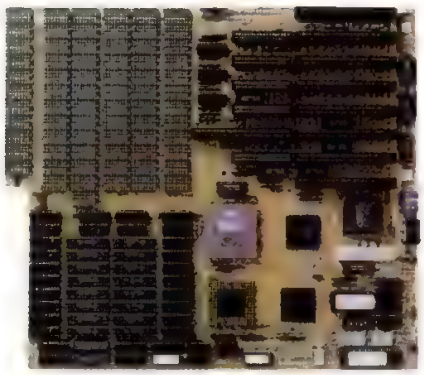

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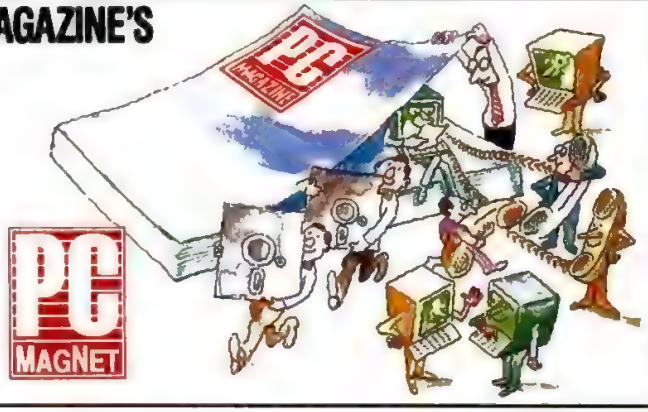

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After Hours

Products for the Leisure Side of Personal Computing

Prism: All the Tone Colors Of the MIDI Rainbow Under Your Complete Control

MUSIC
by Rick Bassett

Magnetic Music published *Texture*, one of the earliest MIDI music sequencer programs for the PC. Now it has unveiled *Prism*, a 16-track graphics-oriented sequencer based on *Texture* but geared toward novice music makers. A mouse-driven application, *Prism* features pull-down menus, windows, and other Macintosh-inspired amenities.

Prism's windows present a lot of information without becoming too cluttered, and the software imaginatively uses color to logically group screen objects. There is detailed help for every window.

Like *Texture* before it, *Prism* organizes your music into patterns that are linked together to form a complete composition. This pattern-based system is familiar to owners of drum machines. Each song can have up to 32 different patterns and each pattern can be up to 1,000 beats long—over 8 minutes of music at a medium tempo of 120 beats per minute.

Prism's pattern-based structure makes it easy to move sections and verses around and reorganize your piece. Because of the blocklike nature of the patterns, however, you can't record a musical part that cuts across patterns. You can work around this limitation, though, by copying several patterns onto one larger pattern.

Once patterns are recorded, as many as 50 of them can be linked together. Through the link editor, a pattern may be repeated many times during a piece, each time with a different tempo, or with different tracks muted or transposed. The third time through a verse, for instance, you could speed up slightly, move to a new key, and bring in a piano solo.

Prism divides each quarter note into 96 clock pulses. This provides enough rhythmic accuracy for most applications, particularly for novices. Patterns can be set to end on any clock pulse, allowing easy experimentation with rhythms that do not conform to standard notions of beat and meter.

Prism speeds the recording process in several ways. The track-sheet window displays a grid of each beat of each track, with boxes and stars indicating parts of specific tracks that contain musical material. If you want to re-record part of a track, you can use the mouse to highlight a section for "punching in," tape recorder style.

The punch-in section can start and end on any clock pulse. Clicking on the Select button plays the highlighted section, so you can make sure you chose the right part and make final adjustments.

After punching in, you can undo the punch you recorded if you liked the original better and then undo the undo to make A-B comparisons. If you like doing things the old-fashioned way, you can also punch in manually.

Prism's pattern-based architecture makes certain kinds of recording easy and spontaneous. For instance, you can set a pattern looping over and over and keep recording your part until you get it just right. Afterwards, you can listen to what you played each time through the loop and choose your favorite take. A half-speed button is provided—handy for recording difficult parts without changing your tempo setup.

For people who lack confidence in their ability to play rhythmically, quantizing can correct many errors. This technique rounds off notes so that they start or end on the nearest sixteenth note, eighth note, or other selected note value. A Swing feature allows you to choose a "swing percentage," which can give your tracks a reasonably authentic jazz-swing feel. Too much quantizing can make your music sound robotic, however. A percentage quantize feature

CONTINUES

Prism *features an easy-to-use graphical environment that makes full use of icons and a mouse.*

After Hours

Prism

CONTINUED

that moves notes closer to the beat—but not right on it—would be a welcome addition.

You can cut and paste tracks intuitively, the way you do with a word processor. A section of one or more tracks can be highlighted and cut or copied into an edit buffer, then pasted elsewhere within any pattern. The Select button is helpful here: it lets you listen to the selected material before you edit. Edit regions can be adjusted to start and end on any clock pulse. Fortunately, the Undo feature works on edits, too. *Prism*'s selection filter presents a flexible approach to choosing events to edit as a group.

A Fill option makes it easy to paste in a section several times, filling the region you have selected with copies of the edit buffer. You can also stretch or compress the length of a buffer to fit the region you select. This is a quick and easy way to speed up or slow down your music.

Prism's event editor displays the MIDI data for a track as a simple data stream. Each MIDI event is listed, along with the time of the event and its corresponding data. Unfortunately, this screen does not scroll through the data while a sequence is being played.

The time scaler, time cycle, and mapper windows provide graphic tools for editing your music. The time scaler allows you to draw a curve that changes nearly any MIDI value over time. This is great for drawing crescendos, decrescendos, pitch-wheel motions, or other musical changes. The time cycle is similar but works repetitively—to accent a certain beat in every bar, for instance.

The mapper allows you to graphically map one set of data into another. That's useful for compressing or expanding the dynamic range of a track and creating natural ritards and accelerandos. The time scaler, time cycle, and mapper windows are powerful enough to stimulate advanced users, yet direct enough for beginners. The manual includes a useful chapter on musical applications for these windows.

The manual is an important part of *Prism*. As it explains the software, it serves as a friendly tutorial in basic concepts of both music and computers. Analogies are often made to familiar tape-recording techniques.

Prism supports the MIDI song position pointer and can sync with an external sequencer or drum machine; FSK tape sync is also supported. An included utility converts *Prism*'s files for use with Magnetic Music's *Texture*. *Prism* also reads and writes Standard MIDI Files of types 0 and 1, which allows file exchange with other sequencers.

Although *Prism* has only 16 tracks, you can put data from more than one MIDI channel on each track, so this is not as big a limitation as it might seem at first glance. Sixteen tracks will certainly be enough for many novice and intermediate users, but since *Prism* offers so many other advanced features, it is quite surprising that Magnetic Music cut back on such a basic ingredient.

Prism is a fun and educational environment for making music with computers, and provides plenty of power, especially for its $99 price. There is a separate version for the Yamaha C1 music computer. Finally, when you need to relieve frustration, there's Nuke the Smileys, a game within *Prism* in which you zap smiley faces with your mouse!

List Price: *Prism*, $99.
Requires: 384K RAM, MPU-401 or compatible MIDI interface, graphics adapter, mouse, DOS 3.1 or later.
Magnetic Music, 6 Twin Rocks Rd., Brookfield, CT 06804-1910; (203) 775-7832.

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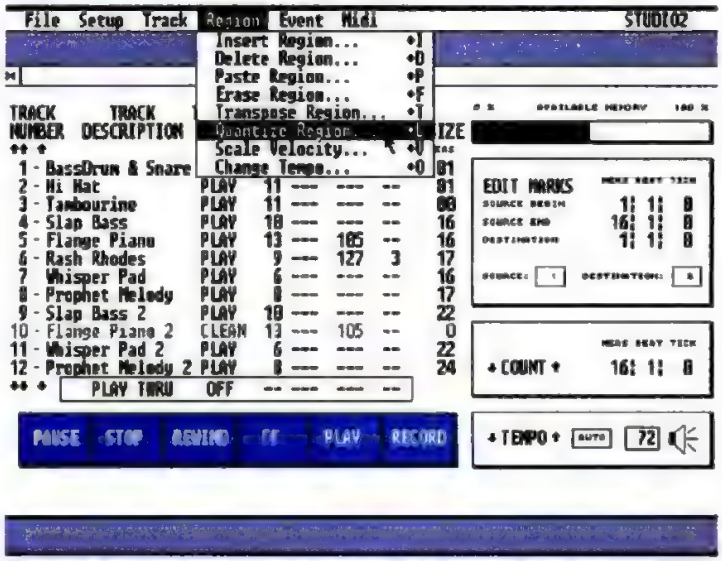
Midisoft Studio: Sequencer Runs Under GEM GUI

MUSIC
by Rick Bassett

Midisoft Studio, a music sequencing program, runs under the *GEM Desktop* graphical user interface (GUI) and uses the pull-down menus and other screen objects native to the *GEM* environment. The GUI gives *Studio* a look and feel similar to music applications written for the Macintosh or the Atari ST.

There are two editions of *Studio*, both of which are mouse-driven. The 64-track Advanced Edition sells for $199, and the 32-track Standard Edition costs $129. Standard Edition users can upgrade to the advanced package for $75.



Midisoft Studio's main screen features the familiar pull-down menus of the GEM operating environment.

The main windows of both versions of *Studio* display a track sheet and the familiar buttons of a tape transport (play, rewind, record). You have considerable control over each track. You can select MIDI channels, make program changes, transpose pitch, and adjust MIDI volume, for example.

All of these parameters can be changed as your sequence plays, which is great for testing out tracks on various synthesizers. Adjusting MIDI volume while listening to your sequence is really helpful for setting balances, particularly if you have a multitimbral synthesizer with only one or two outputs.

I do a lot of sequencing with an old Yamaha DX-7, which, like much early MIDI equipment, transmits only on MIDI channel 1. *Studio* solves this problem by rechanneling input from the computer's MIDI IN port to any other MIDI channel and echoing it to the computer's MIDI OUT port. So instead of constantly resetting the receiving channels on your synthesizers, you simply click on the computer screen.

If your keyboard skills can't always keep up with the music you want to record, a step recorder lets you enter music note by note. The step recorder is flexible enough to accept chords as input and can set up a wide variety of rhythmic units. A scroll bar makes it easy to adjust the length of the notes.

Both editions of *Studio* divide each quarter note into 96 clock pulses, enough resolution for most musical applications. Advanced users might prefer a finer resolution for adjusting subtle timing differences.

Cut-and-paste track editing is simply and efficiently handled

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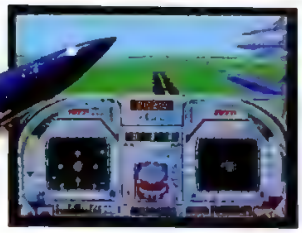

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Midisoft Studio

CONTINUED

through pull-down menus. Edit start-and-end points can be chosen on any beat or any clock pulse. For those who prefer to use their ear instead of remembering measure numbers, edit points can be selected by playing the sequence and clicking on boxes at the appropriate times. This is a handy feature.

There is no way, however, to type in the edit points directly—you have to type the location on the measure counter first or rewind the track to the appropriate place and then click. This is a minor inconvenience, but it is out of place in *Studio*, since data entry is otherwise so consistent throughout the program.

Edit parameters remain in effect when you go from one edit menu to another, which can save time if you are doing many similar edits. However, there is no feature for pasting blocks of several tracks at a time. The stored edit parameters help, but doing a lot of cutting and pasting one track at a time on a 30- or 40-track sequence can really eat up time.

In the Advanced Edition it is easy to scale key velocities through a region of a track or to make smooth crescendos and diminuendos. Switching tempos and creating ritards and accelerandos is also simple. All scaling can be done to regions specified to the nearest clock pulse. These features are not available in the Standard Edition. Both editions have quantization that can shift your notes so that they land on the nearest sixteenth note, eighth note, or other note value that you select.

While you can split tracks by MIDI channel, there is no way to split them by pitch or other parameters. The capability to split tracks in this way is particularly important for editing drum machine parts and keyboard splits. The company is planning to implement these features in future *Studio* releases.

The Advanced Edition's event editor displays a numerical listing of MIDI events, the time they occur, and their parameters, with several features to help keep your mind on the music, not on the numbers. Unfortunately, there is no real way to edit individual MIDI events in the Standard Edition.

Particularly helpful in the Advanced Edition is the event editor's ability to scroll through the data while you play the sequence, highlighting each note as it is played. Pitch bend and other control data can be filtered from the display to make the scrolling more responsive. You can also step through the track, event by event, hearing each event as it is highlighted on the screen.

All of the editing features from the main screen are available in the event editor as well, making it easy to cut and paste or scale parameters within small groups of notes. You can also get a printout of the page you're on or of the entire track.

Studio offers a number of other thoughtful details. A MIDI sensor blinks when the computer receives MIDI data (just the thing for tracking down cables plugged in the wrong way). An All Notes Off command stops stuck notes. There is also a window for sending MIDI mode commands (such as Omni, Poly, and Local Off) to your synthesizers.

Studio reads and writes standard MIDI File formats 0 and 1, which allows the sharing of files with other MIDI software. External MIDI syncing with song position pointer is supported, though FSK tape syncing is not.

The manual is clear and concise, as are most of the commands; so while there is no online help, there aren't many times that it is missed.

The Standard Edition could be useful when you want to record sequences and then cut and paste sections but not when you want to do any other serious editing. The scaling and event editing features of the Advanced Edition are really necessary if you want to fine-tune your performances.

Though *Studio*'s graphic interface makes the screen easy on the eye, the program is primarily text-based, and the graphics never realize their potential for representing music. The ability to edit data by drawing curves or to display notes graphically in some way (traditional notation, piano roll-style, for example) would better take advantage of the interface.

Still, both versions of *Midisoft Studio* are easy to use and include many original extra touches. If you are looking for a simple, straightforward sequencer, and particularly if you like the *GEM* interface, this could be a good program for you. The full *GEM* environment is included with *Studio*, so you can use the graphical interface with other *GEM*-compatible applications.

List Price: *Midisoft Studio*, Standard Edition, Version 1.01, $129; Advanced Edition, $199.
Requires: 640K RAM, graphics adapter, Roland MPU-401 or compatible MIDI interface, DOS 2.0 or later. Mouse highly recommended. Midisoft Corp., P.O. Box 1000, Bellevue, WA 98009; (206) 827-0750.

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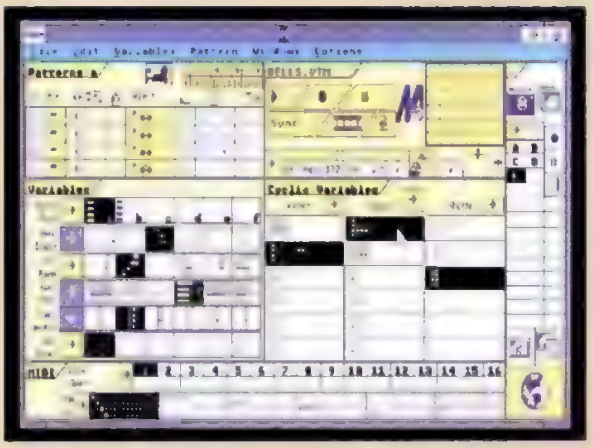

M/pc's complex main screen is intimidating at first, but once you learn your way around, it becomes a pleasure to use.

M/pc Expands Possibilities of PC-based Music

MUSIC
By Robert Kendall

Voyetra Technologies' *M/pc* won't put Beethoven inside your computer, but it will combine your musical creativity with the PC's processing power. In performance this *Microsoft Windows* application (ported from the Mac) can bring back the element of spontaneous interaction lacking in standard sequencing software.

After you feed musical material into *M/pc*, you can manipulate it ad infinitum and send the output to a MIDI instrument. At every stage, you can retain complete control or let the program improvise with randomization functions.

M/pc works by continuously looping four independent voices, each containing up to 999 notes. You enter single notes or chords into a voice either by playing them on your keyboard or by using your mouse to add them via the flexible on-screen editor that shows each note as a square on a grid.

Assigning rhythmic values is a separate on-screen step in another window. There's a lot of flexibility here—you can assign different durations to the same note and have one randomly selected each time that note is played. On the other hand, there's no easy way to do something as conventional as create triplets.

Since each voice is metrically independent, you can conjure up exotic polyrhythms and phasing patterns (parts moving in and out of sync with each other). These techniques—usually fiendishly difficult for live performers—are a breeze for *M/pc* and make for some engrossing results.

The fun really starts when

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M/pc

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you change variables during playback. You can randomize the order of notes, for instance. A little randomization yields subtle variations on the original, while higher degrees alter it beyond recognition. You can randomly mute a certain percentage of the notes if you want. Key velocity, transposition, rubato, and MIDI channel are equally subject to your control.

You can store up to six settings for each playback variable, as well as six different note, rhythm, accent, and articulation patterns. Then the program lets you play conductor. During playback, you activate any stored setting or pattern by clicking on its icon with the mouse.

You can also link different variables and change them concurrently by dragging a baton-shaped cursor around on a grid. For example, moving the cursor up and down might control note-order randomization and transposition, while moving from left to right would change key velocity and note muting. A robot-conductor option moves the conducting cursor randomly around the grid.

During playback, you can save the current settings as a snapshot at any time. Clicking on a snapshot icon then engages all the settings stored in it. To re-create a complex performance, you can save a series of snapshots as a slide show, which records the order of snapshots and the time between them.

M/pc can save a performance as a sequence, letting you load it into sequencers that support the standard MIDI file format. Conversely, it will import MIDI files into a specific voice or play them in the background during a performance.

Since changing variables affects playback in real time, you can easily use *M/pc* in a live performance. You can even control variables from the keyboard of your synthesizer or synchronize *M/pc* with the clock of an external MIDI device.

Just about any musician will find *M/pc* a fascinating toy, but it won't have practical value for everyone. It's ideal for music involving frequent repetition, fragmentary melodic material, fairly static harmonies, and complex rhythms. Some types of rock and minimalism are well suited to *M/pc*'s capabilities. It can also be great for laying down a continuously varying percussion track, especially if you want to develop complex, African-style rhythms.

Its biggest weakness is the lack of any musical intelligence for synchronizing voices harmonically or retaining melodic direction as it randomizes material. Hence, it fares poorly with music that progresses rapidly through many different chord changes or spins out long melody lines.

Learning the program demands a serious investment of time, so it won't appeal to the casual dabbler. You'll have to go through a good portion of the manual before you can make sense of the cryptic icons crowding the main screen, and the program suffers from a lack of on-line help. Once you've mastered the interface, however, you'll find it quite intuitive; every function is always at your fingertips. But the program is very quirky in many areas and isn't yet bug-free.

In the right hands, *M/pc* can be an intriguing, valuable musical adjunct. It can serve as a musical laboratory for experimenting with variations on ideas before committing them to paper. Like most musical tools, though, it requires an investment of patience and imagination for best results.

List Price: *M/pc*, Version 1.0, $289 **Requires:** 512K, Roland MPU-401 or compatible MIDI interface or Yamaha C-1 computer, MIDI synthesizer, mouse, hard disk, graphics adapter, DOS 3.0 or later. Runtime version of *Windows* included. Copy protected. Voyetra Technologies, 333 Fifth Ave., Pelham, NY 10803; (914) 738-4500.

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by Bill Howard

Abort, Retry, Fail?

The Lighter Side of Personal Computing

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How Microsoft Captures Foreign Markets: Treat Canadians Real Good (Until They Read the End of the Fine Print)

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August 26, 1988

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The *WordStar* 5.5 User Reference Manual (page 463) shows off *WordStar*'s built-in math function: three radiation detectors at $175 equals $425, and two cases at $6 equals $18.

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—Want ad, *Quad-City* (Iowa) *Times*, September 21, 1989

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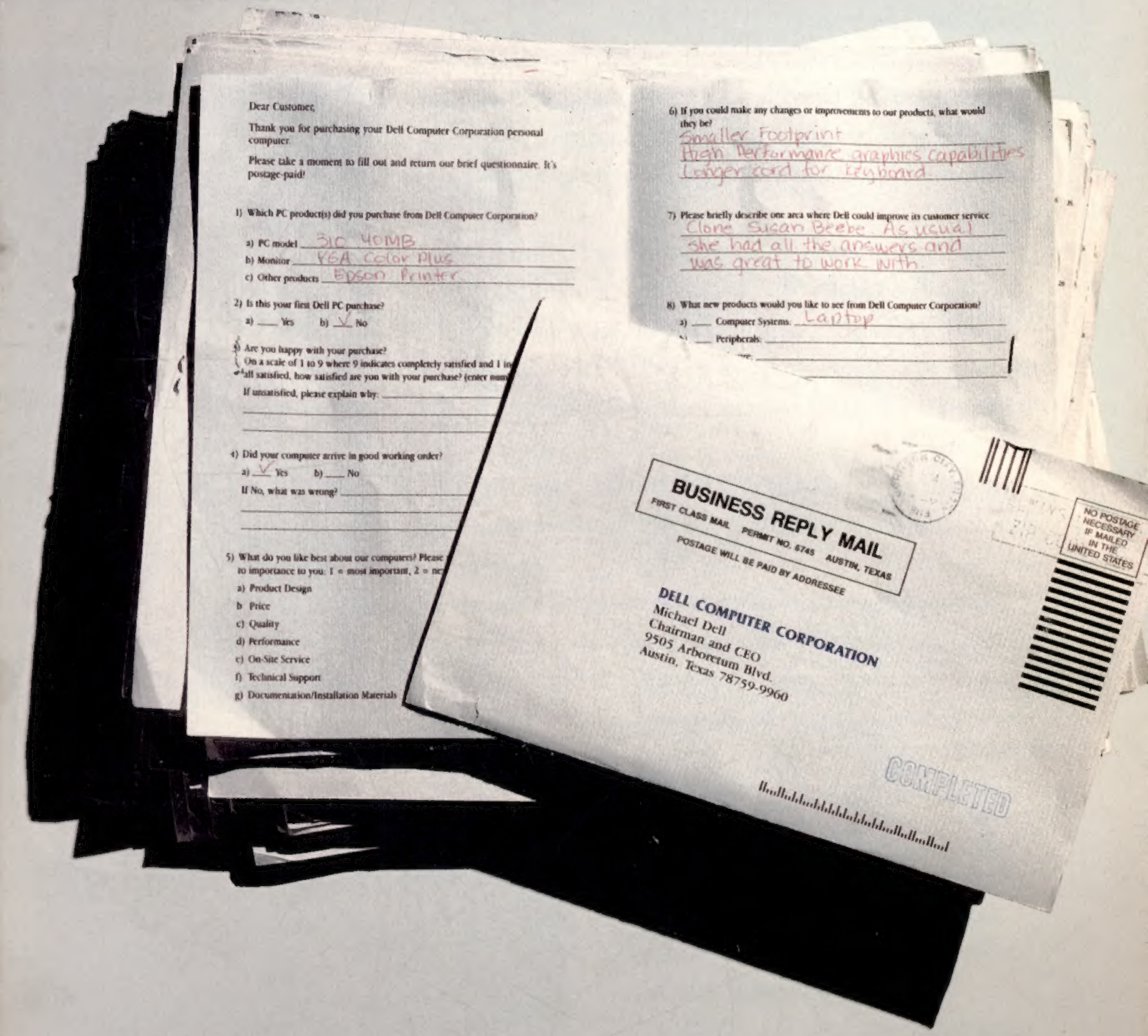

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